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Experience Generated Design: An Approach to Restore Balance in a Culture of Comfort

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I am submitting herewith a thesis written by Joleen Collins Darragh entitled "Experience Generated Design: An Approach to Restore Balance in a Culture of Comfort." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Architecture, with a major in Architecture.

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Experience Generated Design:
An Approach to Restore Balance in a Culture of Comfort

A Thesis Presented for the
Master of Architecture Degree
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Joleen Collins Darragh
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DEDICATION

I dedicate this work to Chloe, Caleigh, Caroline and Corban.
Let this be an example that all things are possible…

…and to Jeff. I love you!

…and to my mother who continues to pursue her dream to complete college, you can do it too!

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First and foremost, I couldn't have gone through this process without the support of my husband, Jeff. Thank you for making me laugh and constantly reminding me that there is life after thesis! Thank you for understanding all of the sacrifices I had to make in order to diligently put this project together.

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ABSTRACT

The purpose of this thesis is to investigate the role of architecture in regulating the positive experience of interaction between people and nature. The concept of a thermally neutral interior environment is unnatural and consequently has negative effects on our experience in those spaces. It is highly recognized that the introduction of natural lighting has contributed to the overall enhanced experience in office buildings, but now the idea of admitting natural ventilation into building design is being researched for its potential to increase occupant well-being. In researching and making connections between the interaction of the interior and exterior realms, I found that control and choice were the most significant aspects of contributing to a positive human experience in the built environment. Because these two aspects are missing in most contemporary office buildings in the tropical and sub-tropical regions, they must be recognized by designers as an important consideration to the well-being of the occupants in which they are designing.

The study concludes that the design of mechanical thermal comfort systems as it currently exists must be recognized as subservient to an approach that emphasizes the potential of passive systems which allows more options to obtain thermal comfort. To that end, this thesis offers an approach that brings the role of architecture back to one of its original goals of acting as an environmental system. This approach can also be adapted to different climates and building types, for it is not suggesting a homogenized experience but rather an architecture that allows for occupants to make their own experience within the space.

PREFACE

This thesis is largely an investigation in a humanist approach to architectural design. The design project, an office building, exists primarily as a tool for the exploration of such an approach, which can be applied towards any design for inhabitation. Throughout the thesis, there are two major research areas: user informed design and environmentally informed design. This project lies in the synthesis of these two and that they cannot be separated.

The thesis topic developed from a concern about the effects that being in a sealed, air-conditioned building has on one's experience of space. I have always been uncomfortable in these types of buildings and used the thesis exploration to research the two components of experience; that being a physical component and a mental component; to see if I could make important connections between the two that would help me understand why so many people suffer inside these types of buildings and more importantly to inform my quest to explore a new approach to designing for thermal comfort in a sub-tropical region.

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1 INTRODUCTION

A thermally appropriate environment is highly individual and a qualitative experience, and therefore calls for individual control. It is essential that buildings can be adjusted to serve people, not vice versa. The building should act as servant and helpmate, not as master.

> *"Thermal qualities – warm, cool, humid, airy, radiant, cozy- are an important part of our experience of a space; they not only influence what we choose to do there but also how we feel about the space. Thermal qualities might be included in the architect's initial conception and could influence all phases of design. Instead, thermal conditions are commonly standardized with the use of mechanical systems that can be specified, installed and left to function independently of the overall design concept. Rather than simply housing an autonomous mechanical system, the building itself can act as a thermal system." Lisa Heschong, 1979*[1]

One of the greatest fallacies of recent modern development is the quest to live independently from nature, that technology can solve all of our needs and problems. This has placed mankind at odds with his natural environment in combating and struggling against its powerful forces. This contradiction has shifted the focus on simpler, more robust and less energy consuming solutions. A mechanism in traditional evolution theory describes that evolution can take a step back to an earlier and less specified, more flexible form and then later be able to find new ways along a new line of evolution[2]. Progress is not always a step forward. The knowledge history provides should be used in new designs.

The purpose of this paper is to discover links between the two seemingly separated world of inside and outside in the context of office designs in tropical environments. My goal is to discover ways for designers to use the basic factors that contribute to a positive experience for humans inside and outside buildings as a new way to approach the design process. I will propose a new way of looking at thermal comfort from the basic needs of humans and interaction with their environment.

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[1] Heschong, Lisa. "Thermal Delight in Architecture." 1979.

[2] Darwin, C. (1859) *The Origin of the Species*, Murray, London.

The Problem

Our dependence on mechanical air-conditioning to solve all of our thermal comfort needs is causing a separation between the inside and outside of buildings and creating a sense of of placelessness. The mechanical systems that are implemented in our buildings continue to be designed with a “one size fits all” approach. Very few buildings or workstations allow occupants to control lighting, temperature, ventilation rates, or noise conditions.

The Root of the Problem

A major link that severed place-based ties between architectural form and climate was the establishment of universal standards for thermal comfort. The root of this problem is Fanger’s Comfort Equation (Figure 1). Povl Ole Fanger, University Professor at Syracuse University (until he died in 2006), was an expert in the field of the health effects of indoor environments. His work is credited with demonstrating that poor air quality in the workplace decreases productivity. His contribution to the research on thermal comfort still defines the state of the art in HVAC technology today.

$$F(M, I_{cl}, v, t_r, t_a, P_w) = 0$$

M = metabolic rate, met
Icl = cloth index, clo
v = air velocity, m/s
tr = mean radiant temperature, oC
ta = ambient air temperature, oC
Pw = vapour pressure of water in ambient air, Pa

Figure 1. **Fanger’s Comfort Equation, by Fanger, P. 0. Calculation of thermal comfort: Introduction of a basic comfort equation. ASHRAE Transactions, 73. Part II, pp.111.4.1-III, 4.20 (No. 2051) (1967).**

This equation comes from years of laboratory experiments with human test subjects who were placed in windowless environments and asked to give their opinions on thermal comfort levels when one of the factors were changed. All of the factors in the equation above are based on the physical sense of skin

sensation. While I don't doubt the scientific accuracy of these experiments, I do question the accuracy of the notion that we can determine comfort levels from testing their affects on only one of our physical senses.

One of the magical things about our physical senses is that they do not operate in isolation. Each of our senses contributes to a fuller comprehension of other sensory information. Indeed, one may not fully understand the information from one sense properly until it can be related to information from other senses.

For instance, Rebecca Maxwell, a teacher and writer who was being interviewed on the Comfort Zone, an internet radio broadcast that covers the topic of "The Cultural Significance of Architecture", says that when she walks into an air-conditioned building,

> *"…it feels dead. It has lost one of its features, one of its distinctions. It becomes all amorphous, too homogenous, and even the size of space is lost, yes, an air-conditioned building torments me, actually."*

The significance of her opinion is that Maxwell is blind. With the loss of her vision, she depends on all of her other senses to understand and experience the spaces she encounters. This should be an important example to designers, engineers, and scientists alike that no one sensory stimuli can create a complete experience for a human being. If a blind person can feel the lack of experiential qualities of a sealed space, then the rest of us have a subconscious feeling of the same.

If the temperature, humidity, clothing index, etc. are the same in both of the pictures in (Figure 2), then why don't we feel the same experience in both environments? Why don't we walk into our office spaces and remark what a beautiful day it is?

Figure 2. **Two spaces at 72 deg, 50% humidity: Two very different experiences**

Two important assumptions led designers and engineers to believe that the establishment of a neutrally thermal environment would contribute to a higher productivity rate in office buildings.

Assumption #1

That people do not want control over their thermal environment.

Assumption #2

The best thermal environment never needs to be noticed and that once a constant comfortable standard has been established, all our thermal needs will be met.

The reader will discover throughout the paper that both of these assumptions are wrong, and, in fact, the opposite is true. Fanger, himself, concluded in his paper "Assessment of man's thermal comfort in practice," that:

> *"Another problem which has hardly been investigated at all is the possible influence of non-thermal environmental factors on man's thermal sensation. Even though an influence from, e.g., light (colour) or sound on man's thermal sensation has not yet been found, the possibility of the existence of such a pure psychological influence cannot be excluded, and an experiemtal investigation of the problem would therefore seem to be relevant." Fanger, 1973*

The Cost of the Problem

The sub headings below highlight the extensive problems that are associated with the overuse of HVAC systems to control interior environments.

These costs are all important, but the focus of the research is how all of these factors together lead to a sense of placelessness and lowered quality of human experience inside buildings.

Environmental Degradation

Like many other technological systems, air-conditioning is popularly believed to be part of the environmental crisis, even by those who would not dream of living without it! Their contribution to environmental degradation is widely researched and documented. Buildings and their operations account for 75.7% of the total energy consumption in the United States, 50% of that accounts for the heating and cooling of commercial buildings.[3] Buildings and their power requirements, account for the largest portion of the nation's total carbon dioxide emissions.[4]

Sickness

The cost of being in air-conditioning all the time was being recognized in the 1980's as Sick Building Syndrome (SBS). These negative physical symptoms (Figure3) were evidence of a lack of positive experience in sealed buildings.

A study was done on 900 French women who work in two different types of office buildings, one type that uses HVAC systems and one type that is naturally ventilated. Figure 4 shows that the women in buildings with a/c have significantly more instances of

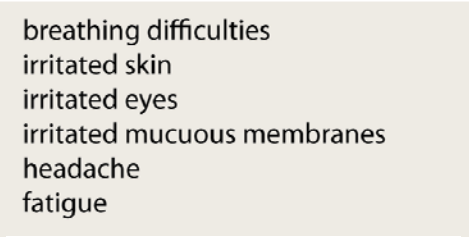

Figure 3. **Symptoms of SBS, image by author**

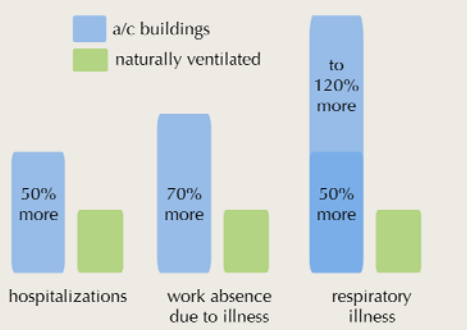

Figure 4. **Comparison of a/c vs natural ventilation**

[3] Architecture 2030, Inc. Data Source: US Department of Energy and Energy Review 2011.
[4] Emissions of Greenhouse Gases in the United States, 2008. http://www.eia.doe.gov/oiaf/1605/ggrpt/index.html

sickness than their counterparts in naturally ventilated buildings.[5]

Separation from Nature

Psychological factors like anxiety and separation from nature are more subtle and harder to quantify, but it is becoming increasingly evident that they exist. These needs affect overall health through their relationship to fulfillment, quality of life, and psychological health. Where failure to satisfy survival needs may lead to serious illness or death, failure to satisfy the well-being needs produces the "gray life"[6] of psychosocial maladjustment and stress related illnesses that are all too common in office dwellers.

While the advent of air-conditioning and electric lighting had the good intention of reducing stress on workers such that they could be more 'productive,' the unintended consequences may well be part of the cause of such stresses.

A Culture out of Balance

Are Americans addicted to air-conditioning? The culture's addiction to anything associated with comfort is evident most recently in the astounding numbers of obese Americans, due, in part, to the addiction to fast food and lack of strenuous activity. A study by a team of 20 medical researchers across the United States published a paper exploring ten other "equally compelling" explanations for the nation's obesity epidemic. One of which was the "reduction in variability of ambient temperature" as a potential villain. Because of central air-conditioning and heating, they wrote, today's population spends much more of the year in environments that are within the thermoneutral zone (TNZ) – the range of air temperatures at which the body doesn't have to expend energy to maintain its normal internal temperature of 98.6. The authors concluded that "increased use of air-conditioning might be something that is easily modifiable and for which modifications in the direction that would hypothetically reduce obesity levels would also have added benefits (e.g., a more healthy and alert population and less use of fossil fuels)."[7]

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[5] Ackerman, Marsha E. *Cool Comfort*. 2002, p. 122

[6] Heerwagen, Judith. "Psychosocial Value of Space." Whole Building Design Guide, 2008

[7] Cox, Stan. *Losing Our Cool*. 2010, p. 123

This addiction to comfort is also evident in another astounding figure: that fully 85% of our cost of fuel in the Middle East war effort from 2002 to 2008 was spent on providing generators to run air-conditioners in the tents of soldiers, reported by Reuters, Summer of 2008. In both Afghanistan and Iraq, it was believed that U.S. crews simply could not have survived the summers in enclosed, heavily armored vehicles like the Humvee were they not fitted with air-conditioning. However, military historian, Jon Grinspan, pointed out an important unintended consequence of such an assumption when he remarked that in Iraq,

> *"American troops are too removed in their vehicles, fighting for Iraqi hearts and minds with a drive-through mentality. The old open-air jeeps meant that soldiers could, and had to, interact with the people of occupied nations; the closed, air-conditioned Humvee has only isolated American forces from Iraqis."*[8]

The Case for Adaptive Thermal Comfort

Thermal comfort in buildings has, again, received considerable attention in the last few years and the importance of adaptive opportunity has been identified. Most recently the work of Gail S. Brager, a Professor of Architecture at the University of California, Berkeley, and Richard de Dear, Professor of Environmental and Life Sciences at the University of Australia, Melbourne have challenged the notion of standardized thermal comfort inherent in Fanger's formula. The two professors and researchers sought to break the dominance of universal thermal comfort standards and to facilitate a return to a more person-centered approach to building design and environmental control that is healthier and better connected to place. This notion also points to an outcome that might provide a better overall experience of space.

The basic tenet of what they have coined as the 'adaptive model' is that building occupants are not simply passive recipients of their building's internal thermal environment, but rather, they play an active role in creating their own thermal preferences. People actually prefer to make themselves comfortable.

Another tenet is that levels of thermal comfort can be adapted by physiological and psychological factors, not just skin sensation. The research that has been done by Brager and de Dear directly acts as a springboard for this

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[8] Cox, Stan. "Losing Our Cool." 2010, p. 107

thesis that is concerned with the negative psychological effects of being in a closed environment due to the desire for thermal neutrality.

The Need for a New Approach

Exploring and understanding how an individual experiences an environment requires consideration of how to approach the design as well as what design tools become important. To become empathetic to how someone perceives the space, one must develop design tools that fit the situation and user that they are trying to understand.

The focus on thermal comfort for buildings has been based on the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standards. The goals of ASHRAE are laid out in *Standard 55, Thermal Environmental Conditions for Human Occupancy,* which considers a building design thermally successful if only 80% of their occupants are reasonably comfortable at any given time; and *Standard 62*, *Ventilation Requirements for Acceptable Indoor Air Quality,* which also considers an 80% satisfaction rate of quality of air as a successful building design.

Figure 5. **Two biggest complaints by occupants of office buildings**

It is becoming apparent that despite the obsession and quest to obtain a thermally neutral environment in our buildings, our current standards and efforts are not working very well. In many studies done on office buildings, the number one complaint is, "I'm too cold," while the number two complaint is "I'm too hot." Keeping everyone comfortable at the same time is an elusive goal at best.

In a survey done by the University of California, Berkeley, 35,000 occupants in 215 sealed office buildings designed to meet the ASHRAE

Standards. Only 11% of the buildings lived up to Standard 55 in keeping 80% of the occupants thermally comfortable, while only 26% are meeting the Standard 62 of keeping 80% happy with the quality of air.[9] Another study says that up to 40% of today's new buildings and renovations are still reporting instances of Sick Building Syndrome.[10]

These statistics combined with *The Cost of the Problem*, discussed above, are enough evidence to suggest that there is a need to explore a new approach to designing for a comfortable experience in office buildings.

Thesis Objectives

The goal of this thesis is to suggest a new design approach that challenges the common practice of relying on HVAC engineers to develop the thermal criteria and comfort of our buildings. I developed design principles that were generated by looking at the experience of occupants inside office buildings in relation to their interaction with the natural forces occurring outside. This generated an approach that can assist the designer in thinking about achieving thermal comfort in a new way, before they think about adding mechanical technology. This approach keeps designers in tune with the overall effect on the human experience of the spaces they are designing.

Thesis Questions

1. How does the sealed nature of contemporary office buildings affect the occupant's experience of space and place?
2. What clues can be discovered by looking at mankind's basic human needs and how the natural environment contributes to their fulfillment?
3. Can these clues offer design principles that can be used to inform a more balanced approach?

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[9] *Air Quality and Thermal Comfort in Office Buildings: Results of a Large Indoor Environmental Quality Survey.* University of CA, Berkeley.

[10] Environmental Protection Agency's Indoor Air Quality Program (htpp://www.epa.gov/iaq/pubs/targetng.html):

Thesis Statement

While many designers and theorists separate the idea of the occupant experience and environmental forces, it is important for architects to understand the connection between these two design concentrations. The focus of this thesis is to research both categories and suggest an inseparable bond between the two. These connections are the theoretical basis to inform an alternative approach to design. Designing for a rich and varied environment with a close relationship with nature will demand an architectural response whereby spatial arrangement will be determined by the occupants' anticipated interaction with natural forces that are either modified, excluded, or brought in by the design, thus creating a positive experience inside.

Hypothesis

The outcome of the thesis shows that through an experience generated design approach, building design can effectively incorporate factors of the tropical climate, along with the workplace user's needs. This creates buildings that interact with their environment vs. struggle against it, therefore creating space that enhances the human experience. Hence, the research-backed approach enables and provides the designer with a wider range of design opportunities to meet thermal comfort requirements for their buildings. This releases the designer from solely relying on mechanical equipment design and helps towards achieve a *balance and integration between comfort and experience*. It brings about awareness that fulfilling the basic human needs for an enhanced experience of place can be met through spatial design principles first, with application of appropriate technology second.

Methodology & Thesis Organization

In order to achieve the objectives of the thesis, I used the following methodology: Exploratory Research of relevant literature and Research Analysis thereof as a basis to form the new Experience Generated Design Approach and then testing the approach on an office design in a tropical climate.

In Chapter 1, the Introduction attempts to bring about awareness of the overall topic, the perceived problem, and give the reader an idea of current research being done on the topic, as well as offer guidance to the order and importance of the paper.

Chapter 2 highlights the overall analysis of the User-Informed Research: Workplace Experience and the Environmental-Informed Research: Experience of Place. There is a section that covers the important connections being made within the two lines of research that will inform a new approach to design.

In Chapter 3 the development of the Experience Generated Design Approach is documented as a graphic framework on research synthesis of how humans experience space and place at the same time and at different scales.

In Chapter 4 the design approach is tested on specific site and program.

In Chapter 5 the paper concludes with Results and Discussion.

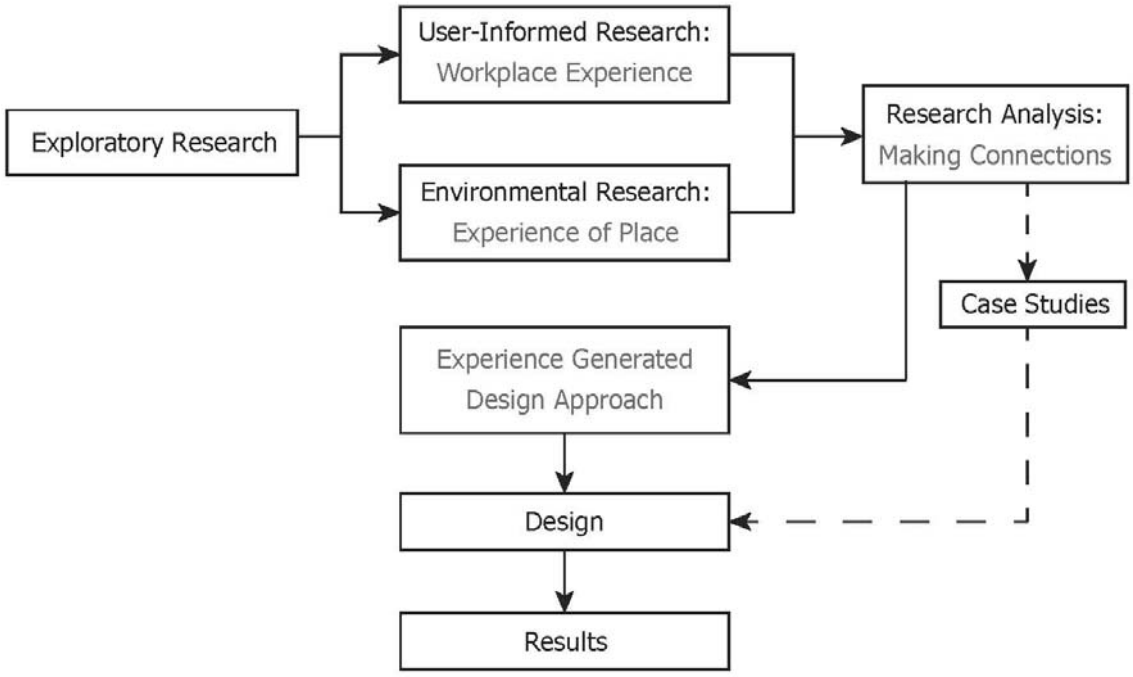


Figure 6. **Thesis Organization Diagram**

Relevance, Scope, and Limitations

The importance of this topic is crucial during a time when energy efficiency is of paramount concern within the building industry and the world at large. In the architectural profession, much of the discussion is about energy efficient light bulbs vs. daylight or energy efficient HVAC systems vs. natural sea breeze, but the conversation could be more about how to integrate both. Furthermore, the conversation could move towards looking at the actual experience of the occupants we are designing for and their potential role in creating an energy efficient building. The new approach is not about completely disregarding the mechanical systems and technology that we have developed, but rather understanding how the interaction between these technologies and our natural world may be best informed by observing the person/occupant who is directly affected by this interaction on a daily basis.

The thesis focuses on one aspect of the sustainability topic that does not get much attention, the human experience. The overall experience of a human being encompasses much, but the factors I focused on is the interaction between humans and nature and how it can be enhanced through the spatial design of architecture. There is a lot of conversation about energy efficient products, passive design systems, and governmental regulations but where this conversation is lacking is in how the occupant experiences these products, systems, and regulations. If this type of conversation would have been happening alongside the development of large scale hvac systems in buildings vs. the static laboratory experiments, this paper may not have been conceived.

This thesis will not contain information on how to design a building for natural ventilation and natural daylight, but rather tries to inform designers about why this approach may be beneficial for the experience of the occupant. The results may assist in the passive design systems of green buildings. Neither will it cover great depth regarding the exact measurements of the building design and its measured performance, but rather is a study that seeks to inform designers about guidelines and spatial design organizations that can best accommodate air flow and natural daylight in a tropical location, while at the same time enhancing the experience of workplace activities. The design test is taken through the schematic phase only.

2 EXPLORATORY RESEARCH

The choice of an exploratory approach to research came about due to the limited amount of singular research work available on the effects of a sealed and thermally neutral environment on the psychological human experience. I chose two fields of study in which to focus that I thought would offer or reveal important connections amongst one another to inform an alternative design approach. The first branch I have named User-Informed Research, which encompasses research done through the field of Environmental Psychology, Sensory Design, and Biophilic Design. These fields of study seek to understand the human experience in their built and natural environments and how each can affect the other.

I conducted research in two seemingly separate areas to find connections that could inform a new approach to the way architects design for the thermal comfort of their buildings, contributing to an overall enhanced experience in the workplace and in the lives of the inhabitants. The two separate areas are user-informed design and environmental, sensorial approach.

While conducting the research, I looked for clues as to how the two are related and specific insight to how they cannot be separated.

User-Informed Research: Workplace Experience

The goal behind researching this type of information was to discover basic human needs to be met in a workplace environment to not just keep occupants healthy and safe, but to make it a better workplace experience of thriving, creativity, and reaching their full potential. The literature reveals a better understanding of the user and of their activities. More importantly was its implications towards ways that architectural form can assist in making these enhanced experiences possible. I specifically examined ideas behind the basic human need for interaction with nature as a guide to finding important connections with the second body of research.

The basic concept of working in an office building is relatively a new phenomenon and has developed on the tails of the industrial revolution. Because the interior nature of this type of work is very different than the outdoor nature of our biological ancestors, designers must realize that there are inherent differences in the way we adjust to interior spaces as opposed to exterior. Thus, two important factors become relevant for designers: understanding the office users and their activities.

Understanding the Users

A person's everyday experience of space is largely dependent on many individual factors such cultural and social context, as well as their current emotional status. Such a wide range of seemingly unidentifiable perceptions can be difficult for architects to understand and is therefore often neglected in design. Such disregard has led to an increasing number of architects who create buildings as objects to be visually understood rather than experienced by a person or community. The quest for thermal optimum through hvac systems that allows these buildings to take no thought of their environment supports this design habit.

Architectural studies within the social sciences, or behavior research, focus primarily on understanding who the users will be and how they might interact, use or even understand the characteristics of a space. Through observation and research, designers can begin to understand what is going on psychologically and socially within a certain setting. Research on Environmental

Psychology, Biophilia and Sensory Design served as guides in the study of the psychological relationship between building users and the built-environment.

At the individual level, a highly effective office space is one that has positive impacts on work performance, psychosocial well being, and health. This section discusses how a building can potentially affect each of these outcome areas. It is more useful to begin with a discussion of well-being, however, because it is less well understood than analysis of building performance and occupant health.

Biologist Stephen Boyden (1971), in an article on the biological foundations of well being, distinguishes between "survival needs" and "well-being" needs. Survival needs deal with aspects of the environment that directly affect human health, such as clean air and water, lack of pathogens or toxins, and opportunity for rest and sleep.

Well-being needs, on the other hand, are more indirect in their locus of impact. These needs affect overall health through their relationship to fulfillment, quality of life, and psychological health. Where failure to satisfy survival needs may lead to serious illness or death, failure to satisfy the well-being needs produces the "gray life" of psychosocial maladjustment and stress related illnesses. Among Boyden's well-being needs are several that are directly relevant to building design. These include:

- Opportunity to engage in spontaneous social encounters
- Freedom to move between one social phase and another (from solitary work to group interaction)
- Opportunity to engage in a full range of species typical behaviors (creativity, self expression, cooperation, exploration)
- Noise levels not much above or below that in nature
- Meaningful change and sensory variability
- An interesting visual environment

The biological approach suggested by Boyden also forms the basis for a number of other theoretical perspectives relevant to design and well being (Orians and Heerwagen, 1992; Heerwagen and Orians, 1993; Kaplan and Kaplan, 1989; Ulrich, 1993; Kellert and Wilson, 1993; White and Heerwagen, 1998). Although each of these researchers approaches the topic from a different perspective, the common thread uniting their theories is captured in the concept of "biophilia" -- the evolutionary tie between people and nature. The term "biophilia" was coined by biologist Edward O. Wilson, who theorized that humans "have an innate affinity towards interaction with nature."

Taken as a whole, this diverse body of research suggests that building environments that contain the essential features of preferred natural settings will be more supportive of human well-being and performance than environments lacking these features. The research on nature is especially relevant to green buildings because many of the leading proponents link their ideas and designs to the vital ties between people and the natural world.

Understanding their Activities

Occupants of office buildings practice unique activities that have specific biological and psychological requirements in order to perform them well. Dr. Judith Heerwagen, an environmental and evolutionary psychologist whose work focuses on the links between building design and human health, well being, and productivity has extensive experience with the study of the office environment and behavior. She states, “Modern workplaces are often seas of bland cubicles that isolate rather than integrate people with anything natural – not unlike the old inhumane cages in the old style zoos.” She makes reference to many studies done that discovered that zoo animals kept in concrete and barred cages were showing signs of depression and boredom. Soon after the results of this study were released, all zoos in the U.S. were required to provide more natural habitats for their large breed animals (Figure 7).

Figure 7. **New zoo design has replaced animals in cages with naturalistic habitats and mixed species displays**

Soon after this change, the animals began to show signs of liveliness and playfulness again, as well as being able to be ‘out of sight’ at will. Heerwagen

believes there are important lessons from the zoo that we can apply to all building designs, but especially in office buildings.

-Look beyond survival to well-being
-Build on 'primitive preferences' and connections to nature
-Design for the senses as well as the body

During the last twenty years, the introduction of green plants and recycling containers have symbolized business owner's commitment towards 'caring' for the environment and the needs of their office workers. However, as shown in the image below, this is not the type of fundamental understanding that it will take to create a better experience at work and interaction with nature.

Figure 8. **Typical office cubicle should be replaced by what type of design?**

What should our work spaces look and feel like? If buildings have become our new habitat, how can we design them to feel closer to our biological setting?

In "Psychosocial Value of Space," Heerwagen describes an important distinction between designing for mere survival vs. designing for well-being. Through her study of biologist Stephen Boyden (1971), she raised two main concerns: (1) there is a mismatch between humans' evolutionary environment and current industrialized settings, and (2) this mismatch is detrimental to human well-being because current environments do not support the full range of evolved survival and well-being needs. Whether it is the increasing presence of environmental toxins or the lack of community and social support in many settings, the places where people live and work now are radically different from those which supported human societies for *Homo sapiens* existence.

Based on these studies, I assert that environments need to fully satisfy both "survival needs" and "well-being needs" in order to be a positive experience for the occupant.

Analysis of User-Informed Research

The literature in this section has not yet been well integrated into building design. Biophilic Design has gotten some traction in the medical and educational fields, but there is much to be desired in its widespread use and especially in the depth of the context I'm suggesting.

In order to incorporate the research in this concentration into the proposed design approach, I have documented these concepts in the format below (Figure 9). It delineates basic human needs, the concepts behind them, and they can be met through spatial design. With research into the environmental factors that affect experience, covered in the next sections, the goal is to see how these can be translated into spatial design features in buildings that support their fulfillment?

Basic Human Needs For Positive Experience	Concepts to help fulfill basic needs	Architectural Possibilities
SENSE OF CONTROL	being able to control thermal comfort, noise, and lighting levels	operable windows, localized thermostats, fans, task lighting, daylighting
CHOICES	multiple settings for individual and group activity, alone, together, inside, outside	fitting workspaces in different parts of the building
BELONGING	spaces designated to certain groups, space and team identity	smaller work zone areas, separated but not isolated, support informal conversation
PRIVACY	ability to have temporary privacy, quiet	small rooms with low clgs. and doors to be used tempor.
PROXIMITY TO NATURE	work spaces have immediate access to outdoor areas that are planted and have views	create outdoor shaded spaces that can connect separate enclosed spaces
PROTECTION	spaces that are protected from harsh sunlight, wind, rain and/or humidity	areas of enclosure during harsh conditions
VARIETY	Variation in color, pattern, temperature	daylight, shadows, plantings, filtered experience of weather

***Figure 9*. Analysis of User-Informed Research**

Environmental Forces: Experiencing Place

In this research category, the aim was to explore climate as one of the base-level ways that we experience place. Appropriate design responses to regional and local climatic conditions are one way to create distinctive designs and establish a sense of place. At the point when designers begin to grasp *who* they are designing for, they can begin to set a series of goals based on that user. The next step is to create a physical entity that informs certain sentiments and emotional connections with the environment. This requires knowledge of specific design qualities such as light, sensorial conditions, temperatures and even the effects of time.

When buildings are sealed tight and act as a barrier to the climate, it will distort occupants' perception of the exterior environment and natural forces. Therefore, important research must be conducted as to how architectural form can contribute to the desired interaction, or lack-there-of, with these natural forces. This integration of building design as a system will contribute to the overall enhanced experience of the building.

Throughout this section I will reveal the potential for thermal comfort to be realized in a tropical environment, at least in part, by architectural form.

Environmental Forces in the Tropics

The tropical locations around the world have become top vacation destinations. Enjoying the direct exposure to sunlight on the beach during a vacation is delightful only because it is our choice to be there and we are dressed appropriately. Under the same temperature and sun exposure in an urban setting while wearing business attire, the experience is much different. Office buildings in the tropics have the potential to offer much delight and much discomfort. It is up to designer to understand the natural forces and how design can help regulate their negative effects.

In order to fully understand the climate of the site where my thesis project will be located, I gathered information on the sub-tropical climate of Southwest Florida, and in particular, Fort Myers. The general climate is characterized by two distinct seasons, winter and summer. During the winter season, the climate has little precipitation and low relative humidity, with a temperature range between 60˚F-75˚F, with occasional lows in the 40's. The summer season is hot and

humid with average relative humidity hovering around 80% and the day time temperature around 90˚F and lows near 75˚F at night.

The negative factors of the climate zone can be characterized as follows:

- Sun: Solar Overheating
- Humidity
- Wind: Little Air Movement during Hottest Months
- Little Nocturnal Temperature Swing
- Intense Solar Radiation and Glare
- Intense Rain Events

The positive factors of the climate zone can be characterized as follows:

- Daylight
- Blue Sky
- Predictable Rain Showers
- Natural Daily Breeze Cycles

Figure 10, on the next page, shows a diagram that associates these factors and how they relate to our experience of place. The information inside the red box illustrates that mechanical air-conditioning systems were able to help solve annoyances caused by the tropical environment. But, the unintended consequence was that it also stripped us of our positive experiences with the environment.

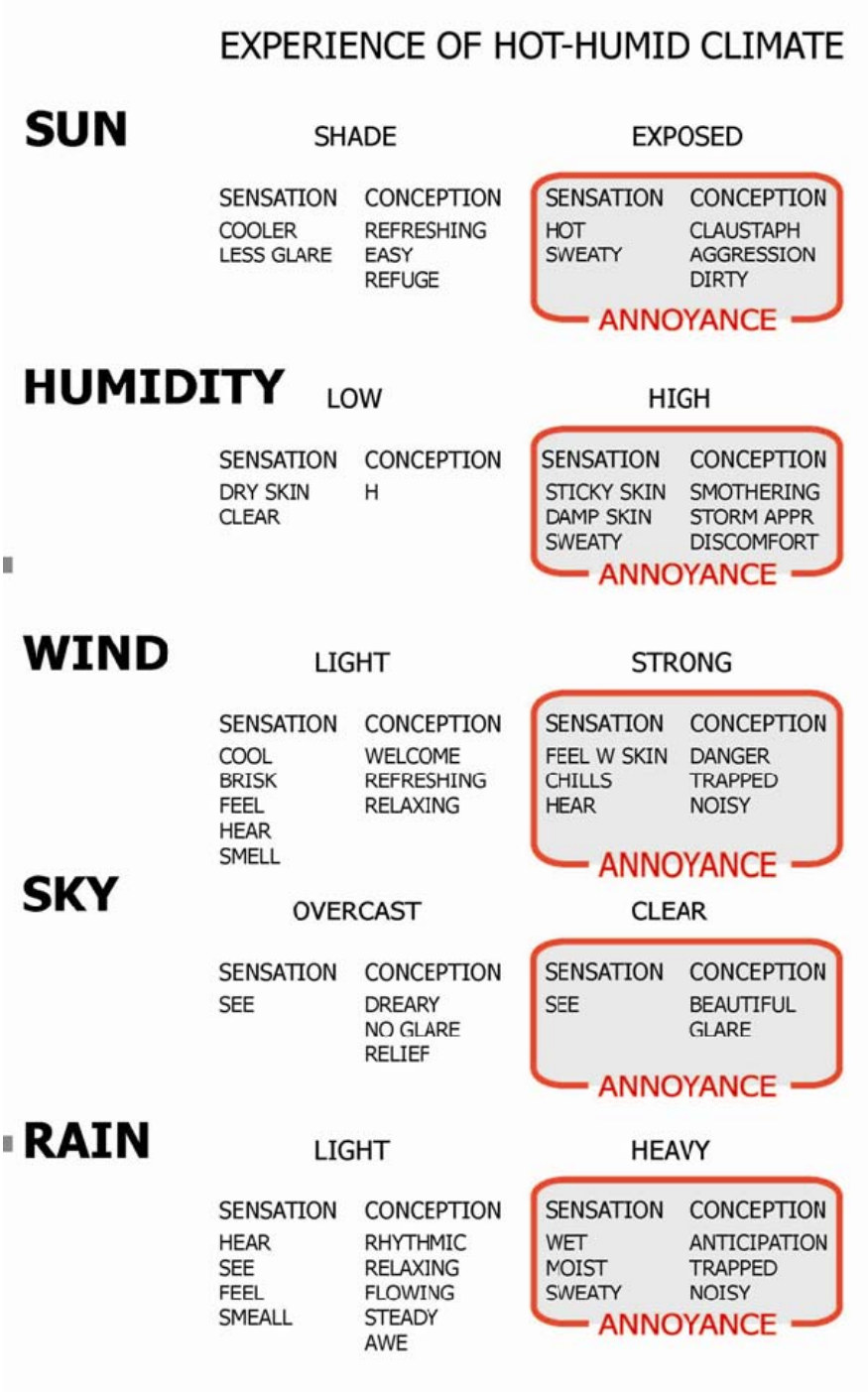


Figure 10. **Early diagramming study of climatic forces in relation to human experience. The right column illustrates the annoyances that air-conditioning relieves, the left column illustrates the pleasant experiences that air-conditioning eliminates.**

Potential for Passive Design in the Tropics

An important part of the new approach will be to consider the potential for architectural form to impact the effect of climatic forces. To mitigate the negative and take advantage of the positive the following general design guidelines have been developed from many and various sources, most noteworthy being *Sun, Wind & Light: Architectural Design Strategies, 2nd Edition* (Brown and DeKay, 2001)

- Situate the building to maximize exposure to breezes
- Orient the building's long axis east-west, to minimize surface area exposed to the hot morning (east) and afternoon (west) sun (when possible)
- Minimize summer solar heat gain by providing shade to cool roofs, walls, and windows
- Provide maximum shading for any windows on the east and west sides
- Maximize opportunities for natural ventilation
- Orient walls and landscaping to channel breezes toward and through the building and site
- Choose materials based on low heat conductance and light colors.

These guidelines can sometimes have inherent contradictions when projects are located on less than optimal sites. For example, to resolve conflicts between thermal and wind orientations in a hot-humid climate the following considerations can be made. Where optimal solar orientation and wind orientation are in opposition, solar considerations to reduce heat gain usually take precedence. However, if the building is well-insulated, has a light external color, and has effectively shaded windows, the change in internal temperature with respect to orientation may be negligible. In such cases, ventilation will have a greater effect on the internal conditions and orientation with respect to winds should take precedence. In general, inlets for natural ventilation can more easily be designed to accommodate for less than optimal wind orientations than solar control devices.

The following graphics demonstrate the applicability of these passive design strategies to increase the comfort zone of building designs before the need to introduce mechanical air-conditioning. The first is based on the bioclimatic chart that places dry-bulb temperature in relation to humidity levels and establishes the combination of these two factors that are most comfortable to a majority of people, thus, establishing a generalized comfort zone. Again, in

order to increase this comfort zone, designers can offer design solutions first instead of implementing mechanical systems at the beginning of the design process.

Figure 11 shows the psychometric chart that was graphed for Fort Myers, FL on Climate Consultant software[11]. In an effort to make the graph easier to understand, Figure 12 shows the existing comfort zone range if no passive strategies were designed in the lightest shade of gray. It then suggests that this comfort zone can be increased, indicated by the secondary gray scale to 67% by designing with passive systems such as creating ample shade, harvesting daylight, and manipulating wind patterns. It is only after these considerations that the designer should think about implementing mechanical systems for the remaining 33%, which is indicated by the darkest shade of gray.

[11] This software can be found at http://www.energy-design-tools.aud.ucla.edu/

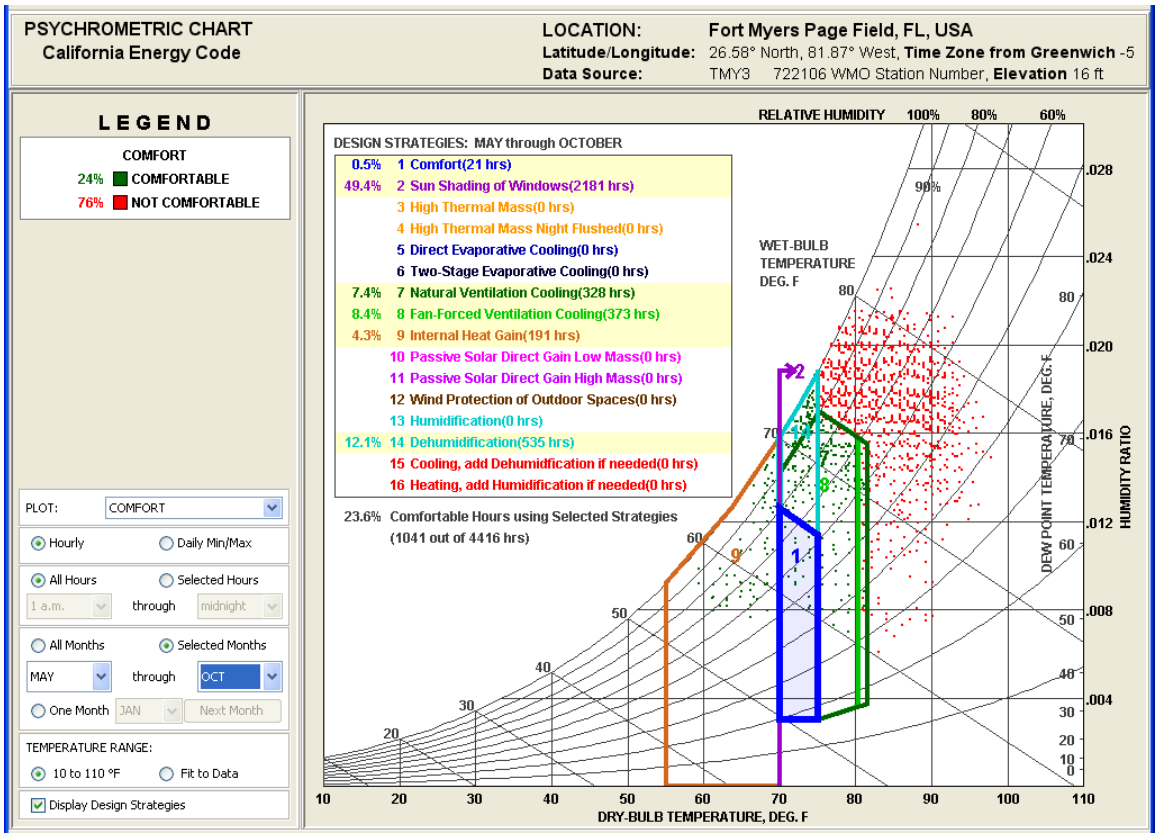


Figure 11. **Psychometric Chart for Fort Myers, FL. Summer months charted. Image created by using Climate Consultant software, which is copyright 2010 by Regents of the University of California and developed by the UCLA Energy Design Tools Group.**

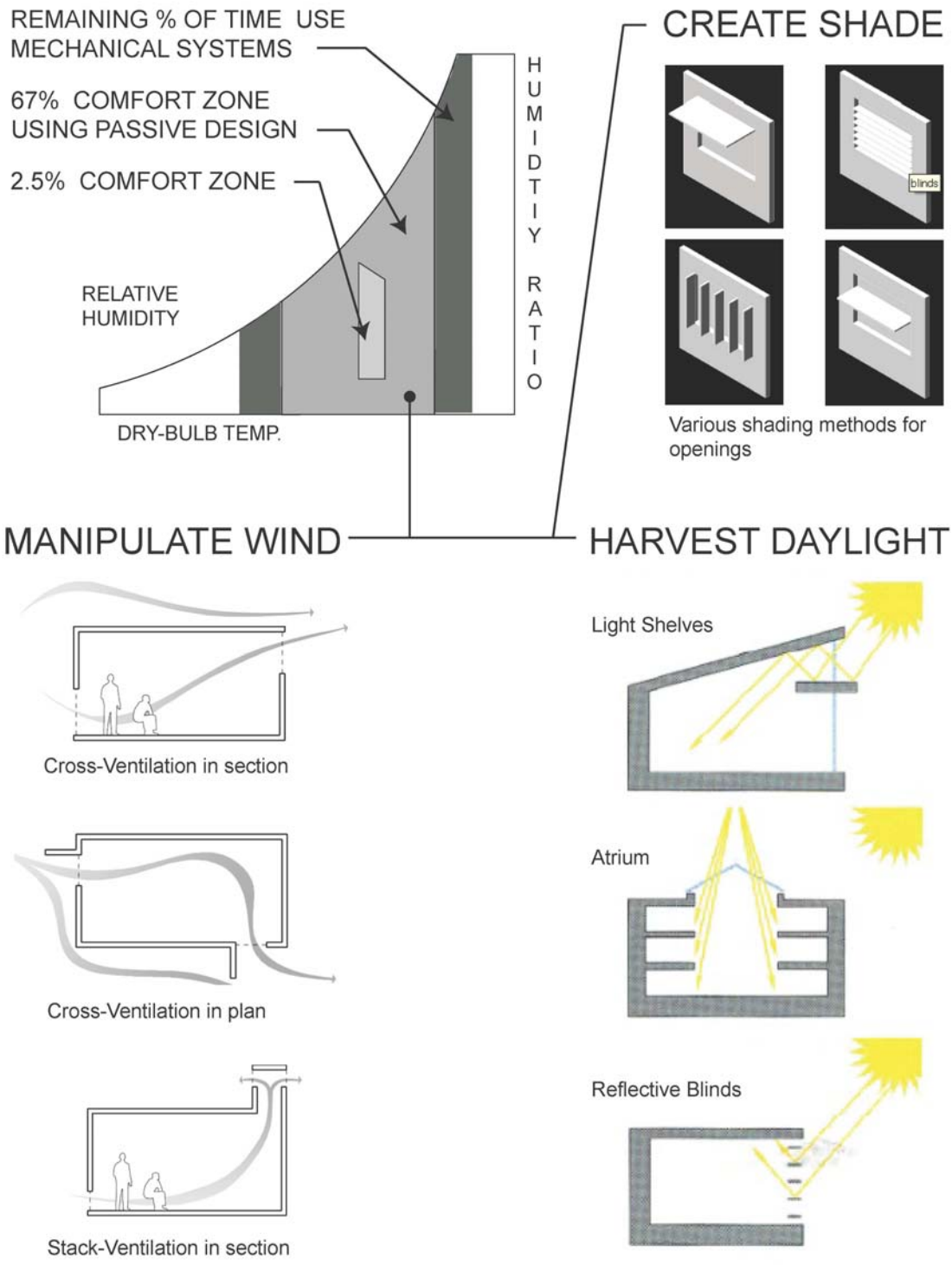


Figure 12. **Simplified Psychometric Chart illustrating an increased comfort zone when using the indicated passive design systems, image by author**

Example of Tropical Vernacular

As mentioned in the introduction, new technologies often overlook the lessons learned in the past. In the case of architectural design and its trend towards more energy efficient designs, much can be learned from the vernacular examples of buildings that can be found in tropical regions throughout the world. The strategies above have been developed from centuries of experimentation with making buildings that act as thermal comfort systems.

Most of the vernacular examples that can be readily researched are relatively small structures, but this does not mean they should be disregarded as important lessons for larger office buildings. It merely suggests that perhaps large buildings should be broken down into smaller components in order to act as a series of smaller buildings in order to take advantage of historic lessons of vernacular strategies.

One of the most popular and widely studied examples of tropical vernacular architecture is the typical Malay house. Untutored builders understood the art of suiting their structures to their environment. They adapted forms to create ventilation techniques for cooling and shading devices for reduction in solar heat gains. They designed using the above strategies based on lived experience and necessity to stay cool and dry.

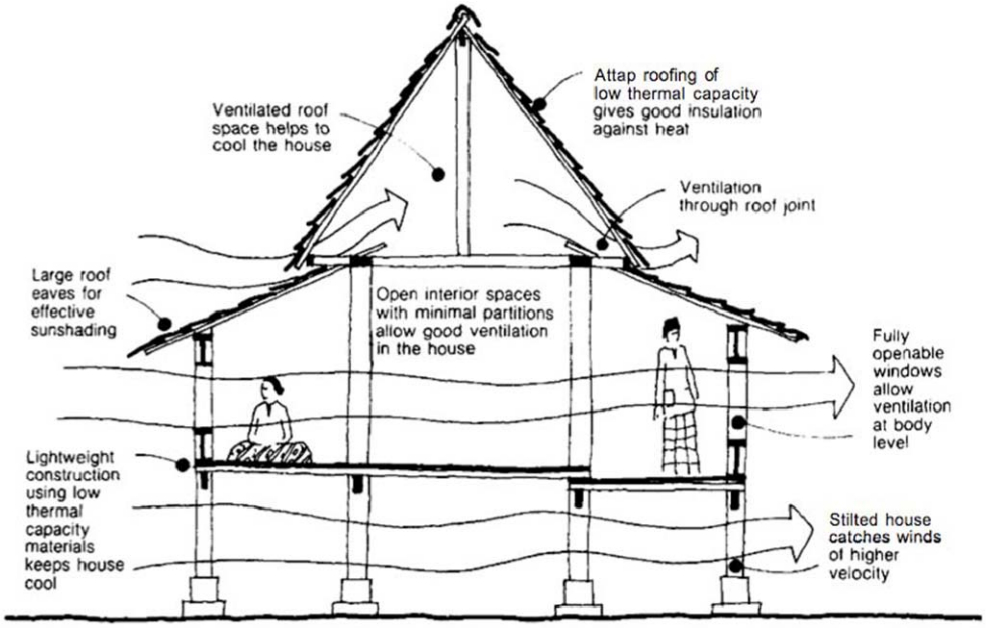


***Figure 13*. Climatic design of a Malay House, Image from: "Can Vernacular Architecture in the Tropics assist with Modern Passive Ventilation Design in Domestic Buildings?" V. Bezemer, January '08, p 3**

Analysis of Environmental Research

Throughout the research in this category, I kept track of what were the most important environmental factors in a tropical climate that could be manipulated or controlled by architectural form and technology. They are summarized in the Figure 14 below.

Natural Forces in Tropical Climate	Concepts to mitigate	Architectural Possibilities
AIR MOVEMENT CROSS VENTILATION STACK VENTILATION	do not block airflow with interior walls or obstructions, create variable ceiling heights and multiple story spaces	operable windows, openings on at least 2 facades, sizing of inlets and outlets
DAYLIGHT	spaces for working need adequate amounts of daylighting	thin plan of office space to allow daylight to maximum work zones
SHADE	provide shade on all exterior walls and outdoor spaces, walkways, minimize areas open to sky	vegetation walls, roof overhangs, brise-soleil, walkways that connect separate bldg's
ORIENTATION	orient buildings east/west with long sides facing north/south for best light and least heat gain, towards favorable winds	variation of envelope solutions depending on direction of sun and wind
VIEWS	create openings that face favorable views	framed views of scenery, bring nature inside
BUFFER ZONES	spaces that are between inside and outside, mitigate effects of harsh conditions such as solar radiation	walkways, porches, vegetation walls, lanai spaces, pergola, buffer zones
FILTER	allowing the 'good' weather to be experienced while protected from 'bad'	large overhangs, plantings, operable windows, enclosed

***Figure 14*. Analysis of Environmental Forces in Tropical Climate, by author**

Making Connections

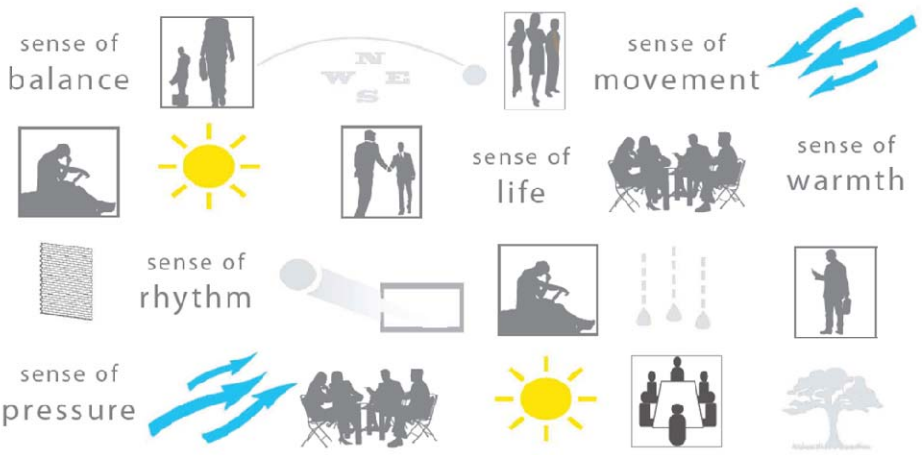


***Figure 15*. Senses evoked by interaction between workplace and climate**

An important part of the exploratory research was discovering connections between the two areas of research. These connections were vital to developing a set of design principles that took into consideration the experience of the occupant and the environmental factors that contributed to that experience. It also helped narrow my search for important case studies.

Connection #1: What is good for nature is good for people

Daylight and views of nature are now well recognized as attributes to increased productivity, which I believe contributes to an enhanced human experience. Air quality has also been linked to increased productivity and experience. Now, natural ventilation is in the cross hairs of many researchers to determine its affects on productivity. It is much harder to gauge the effects of natural ventilation on the psychological well-being, but all the more important reason why this type of research is so important.

For example, in much of the earlier research I did on the naturally ventilated buildings I found that as designers implemented natural ventilation, the productivity rates of occupants went up, which means that the overall experience of the occupant was enhanced. These comments were only noted at the end of the papers as an unintended consequence. This illustrates that while the intent of the study may have been to discover more efficient ways to provide thermal comfort through passive systems, the outcome actually benefited the experience of the occupants.

Connection #2: People like to work where nature likes to play

Another connection is that because landscape represents natural habitat, it should be utilized as a way to incorporate an alternative choice of work space. Integrating landscapes into building designs offer opportunity for choice, variability, and proximity to nature. As the breeze rustles the vegetation, the daylight varies, but never induces glare, as the view of shadows dance across the room. As the design of space allows this to happen the experience of working is enhanced.

Connection #3: People like control when nature becomes unruly

Providing operable windows, screens, localized thermostats, and alternate work stations, occupants feel a sense of control. In the study that was done in footnote 6, there was a documented rise in satisfaction of thermal comfort when an operable window was present within the occupant's sight. While these occupants rarely to never opened the window, its mere presence gave them a sense of control.

3 NEW DESIGN APPROACH

The connections made in the two categories of research and the subsequent building case studies, led to the theoretical basis of a new design approach. The research analysis suggested that the importance of looking at the ability for occupants to choose and control their immediate environment and have the ability to interact with the variety and spontaneity of nature, at will, were the most important factors in providing a space that accommodates an enhanced experience at work. This led to the fundamental difference in the proposed design approach from the existing common approach, which is looking at the given program in a completely new way. Through looking at the type of activities that occur in an office building in relation to a certain scale of the building space used for that activity, a pattern of spatial organization emerges that works for both the occupants' needs and for responding to the natural forces present.

Instead of simply beginning the process by organizing the required spaces into bubble diagrams and looking at square footages, this new approach starts in a radically new way: by breaking down the program into groups of activity types and then examining them by the scale in which they are experienced.

Process

The example design process began with ideas about moments of interaction that happen within the environment of the office space and natural forces occurring outside. From here, I developed a simple matrix that would help organize the investigation into these points of experience. The exploration involved developing spatial organizations that influence the design of a tropical office building. These spatial organizations were designed in a conceptual manner, meaning I had not yet revealed the actual program requirements. This was an attempt to look at the human/environment relationship in an office/tropical setting without being biased by exact site, location or micro-climate information. I created a collection of ideas that analyze and propose new solutions to the negative aspects of sealed buildings in this climate.

When designing for experience, an important design tool for development was evolutionary perspectives. Rather than beginning from a more rigid tool, like the floor plan, the perspective and sections were primarily used to explore more loosely the ideas inherent in a certain experience. The perspective became particularly important because it allowed the design to be seen from eye level, which can drastically change the visual understandings of a space.

Framework for Experiential Design Approach

As seen in Figure 16, the framework for exploration into these points of experience evolved into a matrix format that related activity to scale. The set up of this matrix became the guiding tool for the proposed design approach. The framework allowed exploration into experiential points of a design at different scales, setting up guidelines for exploration into each point of the spatial organization.

For this approach three programmatic spaces and scales are developed based on combining the generalized needs of various office activities.

To clearly delineate how this relates to the research analysis, I have taken the primary words in the first column of each Research Analysis Chart (Figures 9 & 13) and combined them in appropriate ways to show that they are inseparable. These combinations of words can be seen on the graphics in this section.

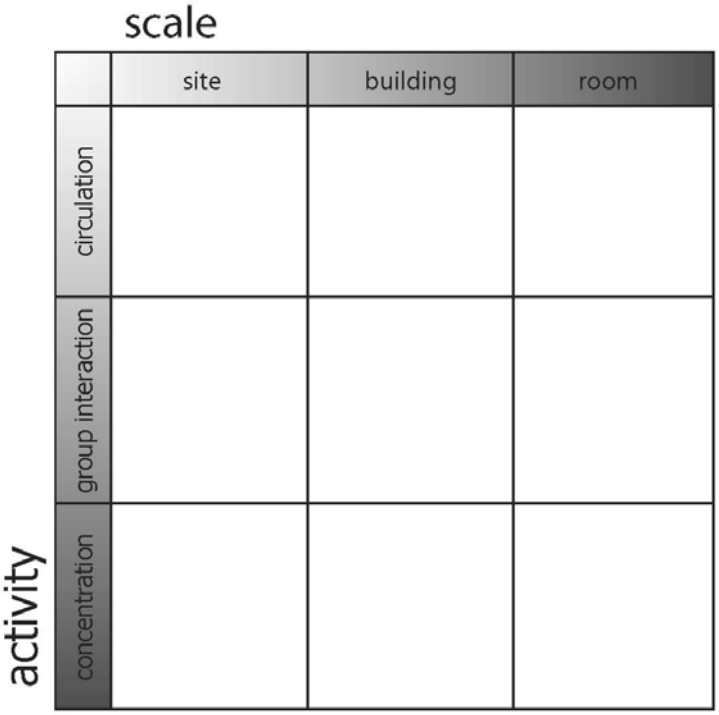


Figure 16. **Matrix framework to explore points of experience at different scales for various programmatic activities in office buildings**

Activity: Programmatic Spaces

The categories along the activity side of the matrix generalize a typical office program into its major activities that makeup the workplace experience: individual and group work, as well as movement from one activity to another. Each generalized programmatic area has input from its own goal for function and desired experience based on the research done on user/occupants of office environments, all the while keeping the relationship to the outdoors as a primary spatial design consideration.

The *circulation* category explores points of experience as the occupant approaches the building, moves throughout the building, and at points where circulation patterns change. These would be spaces such as:

- changing activities: hallways
- engaging a new activity: entrances
- vertical circulation
- welcoming: lobbies
- arrival: parking lots
- departure: parking garages

The *group interaction* category explores points of experience as the occupant encounters co-workers, whether by spontaneous gathering or in a formal meeting. These spaces include:

- formal social gatherings: conference rooms
- informal social gatherings: wide hallways
- spontaneous conversations: stairs
- casual conversation: break rooms
- exchanges of information: work rooms, copy/fax/staple
- informal meetings: outdoor areas

The *concentration* category explores points of experience as the occupant has need to focus and be intent on working tasks. These spaces include primary office spaces, secondary settings where work can be done, and private office spaces for extra concentration:

- phone, reading, research: offices
- computer, one-on-one: open-office space
- focus: temporary small offices
- choice of focus: integrated work stations throughout the building
- focus: informal places to restore, reflect and be inspired

Scale: Relationship with Space

Differing scales throughout the building design is to be considered when thinking about the experience of the occupant in relation to natural forces because this relationship has different consequences in regards to control, whether by architectural form or by occupant or by a combination of both. The underlying notion here is that each scale can be experienced individually, but it is the experience of a range of scales that make up a holistic experience.

The *site* scale explores the idea of how the occupant's experience is to be considered in relationship with the following:

- gardens: site landscaping

- outdoor rooms: view of the city and distant views
- office culture
- sense of place
- climate

The *building* scale explores the idea of how the occupant's experience should be considered in relationship with the following:

- organization of spaces
- effects of social conditions
- journey through space
- overall sensory conditions

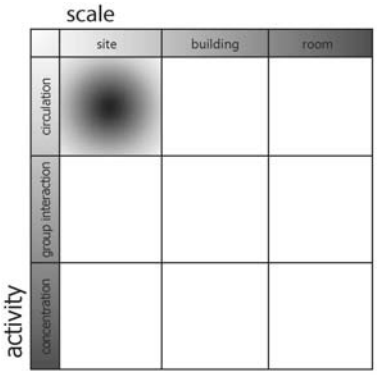
The *room* scale explores the idea of how the occupant's experience should be considered in relationship with the following:

- direct contact with nature
- control over localized comfort factors
- effects on social moments, individual, and emotional states
- highlights of sensory conditions

This search into process and approach created a much less ordered design process in which everything begins to influence each other, but from which the experiences of the person is always the most considered factor.

Experience Generated Design Principles

Welcoming Approach: Circulation at Site Scale



Scenario: In hot climates there is often a negative experience upon exiting an air-conditioned car onto hot pavement that can be upwards of 10˚F-40˚F hotter than the ambient air and then approaching a building under the intense sun or pouring rain.

Design Principle: Experience a shaded walk to the entry with portions of plantings that provide filtered sunlight, rain, and/or breezy shade. This slows the transition from hot outside air to cooler inside air gives body and mind time to adjust from harsh conditions to neutral. Slow the pace from transportation to building, rain or shine. The designer will take into account maximum shade and filter potential by orientation.

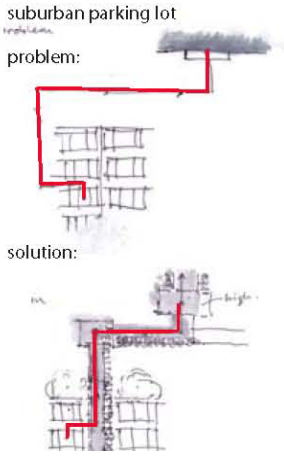


Figure 17. **Diagram of path from parking lot to entry**

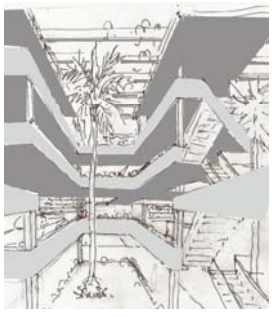
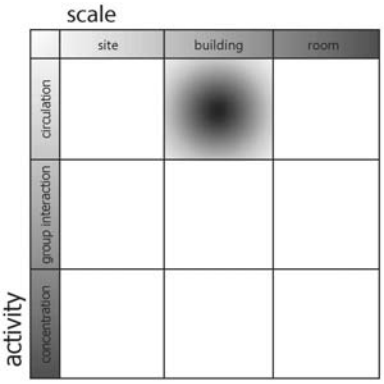


Figure 18. **Sketch of parking garage circulation**

Figure 19. **Welcoming Approach: Circulation at Site Scale**

Living End Hallways: Circulation at Building Scale



Scenario: Office building designers often create double loaded corridors to maximize offices located on exterior walls. They often lead to other hallways and open spaces that offer no relief to outdoor spaces or windows.

Design Principle: Use circulation spaces to transition from work space to social space. All circulation patterns end with access or views of the exterior. This creates an experience of awareness and connection to the weather occurring, gives an extended view from the building and creates moments of restoration and inspiration while in transit.

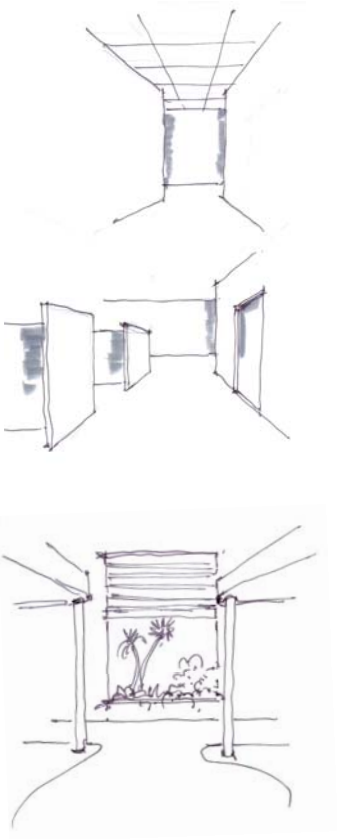


Figure 21. **Sketches, above: dead end hallways, below: living end hallway**

Figure 20. **Living End Hallways: Circulation at Building Scale**

Shady Entrance: Circulation at Room Scale

Scenario: Entrance from hot exterior to cold interior can be a sudden temperature change of up to 35 degrees and 50% humidity in a tropical climate. This may feel relieving at first, but after twenty minutes the body adjusts and begins to feel too cold.

Design Principle: Experience a gradual transition between inside and outside upon entry of a building. Create different degrees of opacity of overhangs to protect, while filtering sunlight and rain. Provide flowering plants. Prepare the body while evoking the senses to transition from hot to cold and bright to dark.

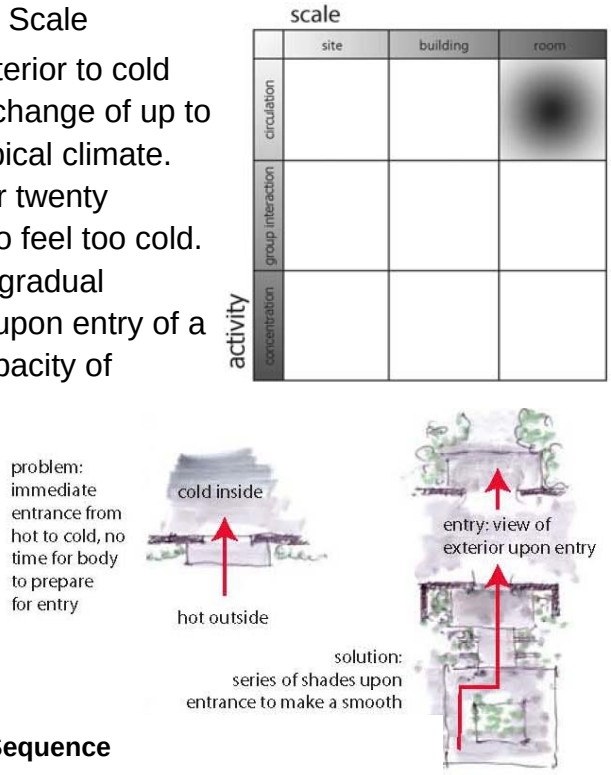
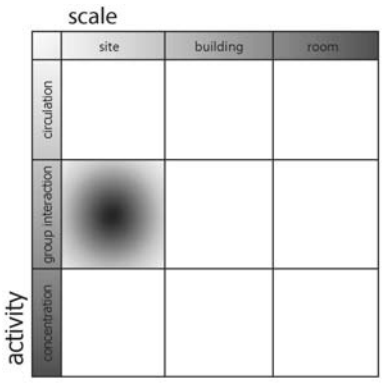


Figure 22. **Diagrams of Entry Sequence**

Figure 23. **Shady Entrance: Circulation at Room Scale**

Social Streets: Group Interaction at Site Scale

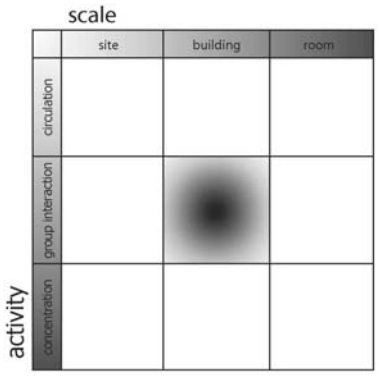


Scenario: Many office building designs are internally focused and tend to shut out the public areas and environmental elements that surround, either by tinted and non-operable windows that support the large hvac systems or simply by not having access to outdoor spaces.

Design Principle: Where outdoor connections can be made between buildings, provide covered walkways that allow breeze and the public to pass through. Also create connections between portions of the buildings for workers to travel through outdoor spaces while in transit. This gives opportunity to connect with others and natural forces occurring. This will naturally encourage group interaction, facilitating spontaneous gathering with co-workers adding variety and a feeling of belonging to a larger context.

Figure 24. **Social Streets: Group Interaction at Site Scale**

Communicating Stairs: Group Interaction at Building Scale



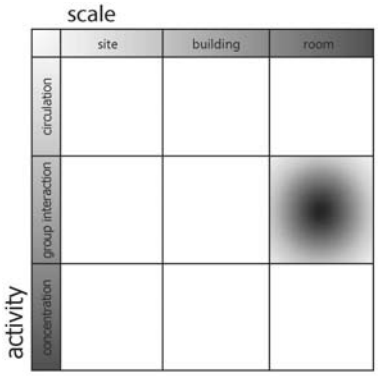
Scenario: Often office buildings do not have enough informal areas for social interaction to spontaneously happen. Often this type of activity happens in a windowless break room around a water cooler. This is hardly an inspiring setting.

Design Principle: Encourage spontaneous gatherings and meaningful engagement by providing enough room in circulation spaces to gather while still allowing people to pass. Use stairways to offer moments of rest and conversation between activities. Since these gatherings will take place in an open space there will be plenty of breeze and daylight for comfort. Also, designers can offer different sized meeting areas and rooms. Many of these meeting areas can be small open areas located within open office settings. These spaces should be comfortable and offer good daylight with access to open air spaces.

Other design considerations are: roof terraces that provide space for social meetings and events. In a tropical climate this would be ideal for collection of breezes.

Figure 25. **Communicating Stairs: Group Interaction at Building Scale**

Conference Connection: Group Interaction at Room Scale



Scenario: Many conference rooms are tucked away in dark rooms because of the use of screens and need for temperature control. Many office designs have one main conference room for clients and others with less desirable conditions for employees.

Design Principle: Place conference rooms in areas that can be connected with direct access to the outdoors. This gives opportunity to create buffer zones immediately outside conference rooms to allow gathering outdoors. Shading devices will control daylight when projection technology is needed. Orient these spaces on sides of the building where weather "events" are present, such as afternoon storms, breezes, the setting sun, etc. The sense of connection to space and place can be strong when experiencing these events in a social setting.

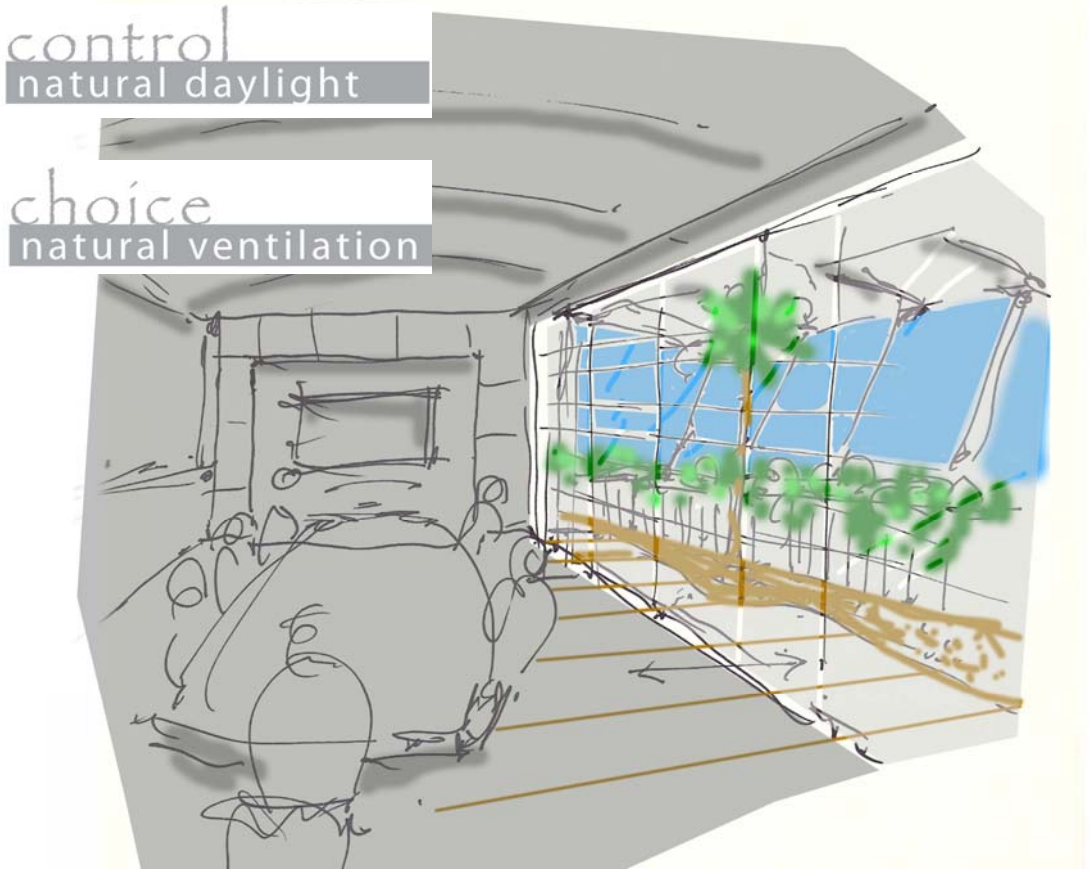
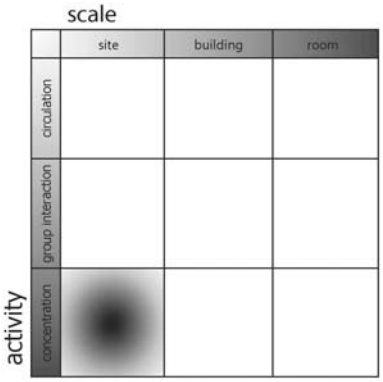


Figure 26. **Conference Connection: Group Interaction at Room Scale**

Inviting Site: Concentration at Site Scale



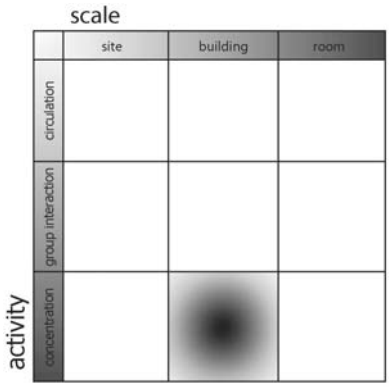
Scenario: Typical office buildings maximize the site with interior conditioned space, leaving only strips of landscape and irrigated lawns which are uninhabitable.

Design Principle: Make the site inhabitable for humans. On good weather days workers can enjoy the outdoors. This gives them another choice for work activities. Providing adequate shade can make these spaces available year round in tropical climates. Outdoor areas should have higher roofs and outlet areas to allow hot air to escape and breezes to pass through. This outdoor/undercover experience puts the occupant in a multi-sensory environment that some find ideal for concentration.

Figure 27. **Inviting Site: Concentration at Site Scale**

Well Organized Personal Zones: Concentration at Building Scale

Scenario: Research shows that many of the illnesses due to stress in office buildings are caused by open office spaces that are too large. The stress is caused by constant auditory interruption and lack of privacy and identification with a small group. The cause of high blood pressure, anxiety, and even heart attacks have been linked to the large “one-size fits all” atmosphere of most open office space designs. The lack of choice and control is evident.



Design Principle: Open office spaces are dispersed into smaller areas to avoid large open rooms where the light and air is “one-size” fits all. Smaller areas with proximity to natural light and operable windows allows for feeling of control and breaks up the monotony of space. These spaces should have adjacent smaller rooms, or quiet rooms for temporary privacy needs.

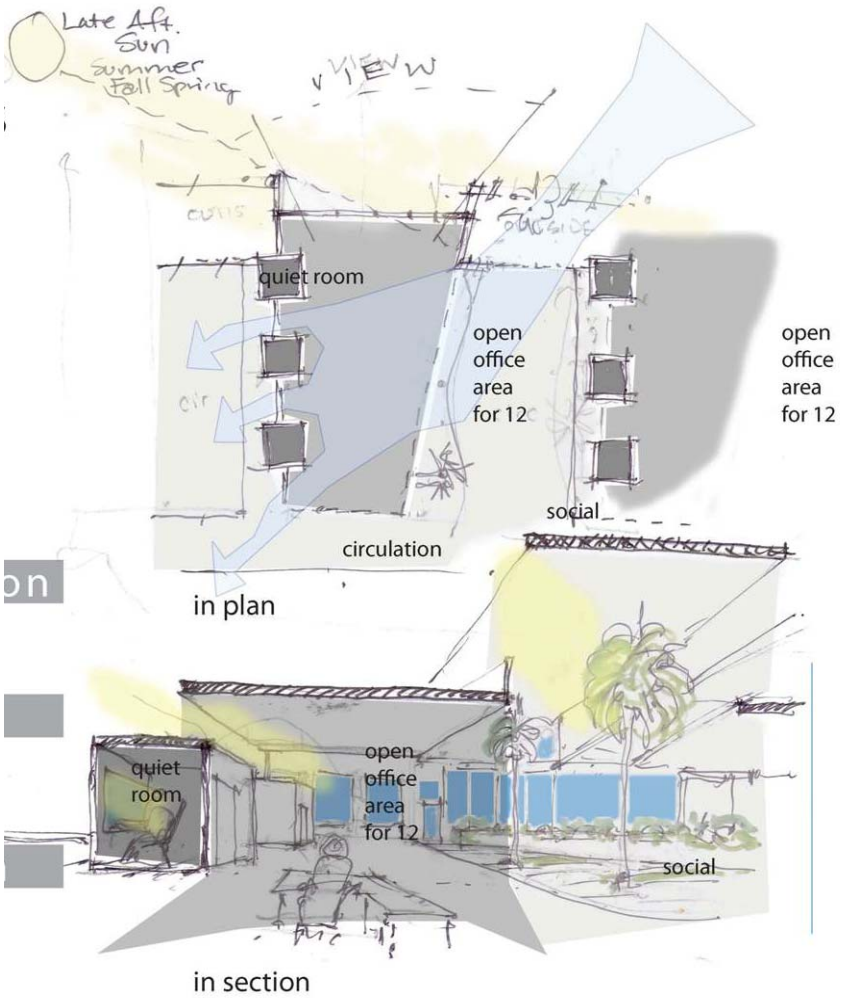
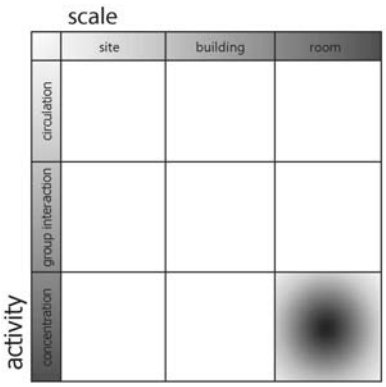


Figure 28. **Well-Organized Personal Zones: Concentration at Building Scale, plan and section sketches**

Office of Choice and Control: Concentration at Room Scale

Scenario: Immediately this program space is presented with questions of scale and its importance on the experience of space. This space above all others can affect the positive experience of office space.



Design Principle: This space will need to function for many different activities: It will also be home base for most employees. It will be a space of identity and belonging. This space should offer choice, connection, access to outdoors, access to social interaction and Privacy when needed. It should offer opportunity for movement between interaction and solitude. Differences in ceilings heights will force air movment, create different levels of light, and an overall sense of variability. This location is the center of the occupant's experience. If this space does not fulfill the basic needs than the it will not be a successful building design.

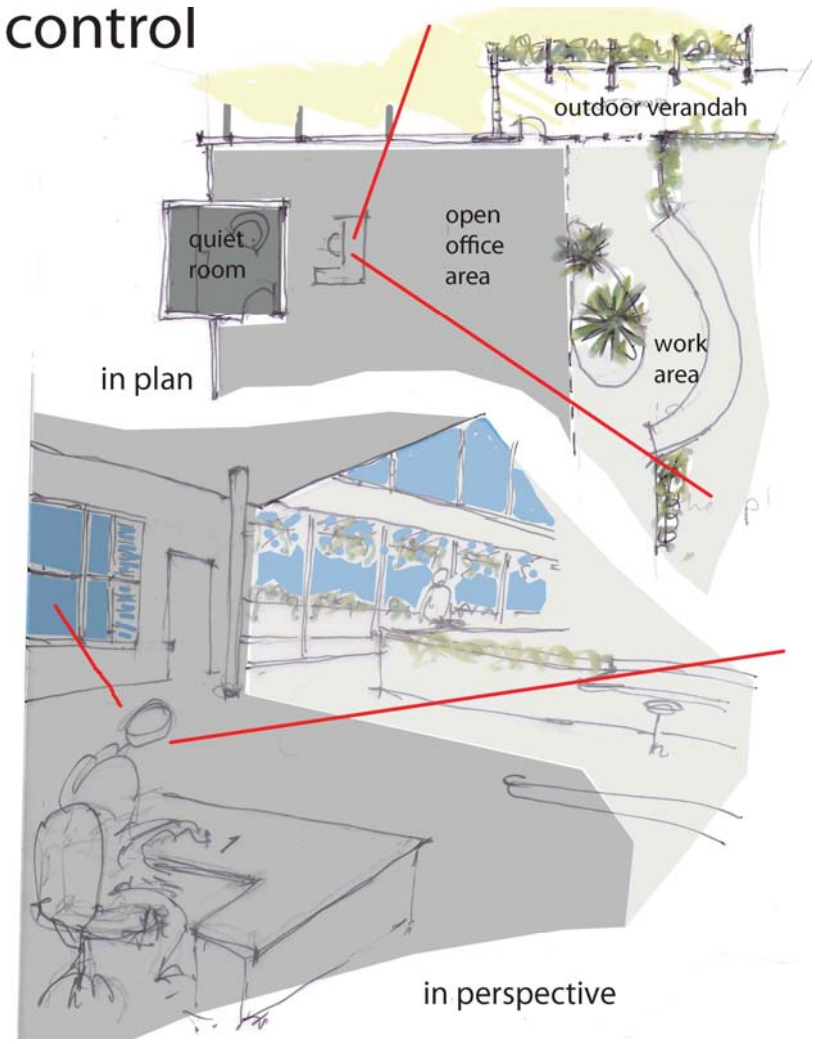


Figure 29. **Office of Choice and Control: Concentration at Room Scale**

Summary: Spatial Gradients

The potential that this approach suggests is that spatial designs have a gradient to them and that spaces flow, overlap and connect in such a way, that no particular space is without important multi-sensory influence from another space. This was a profound confirmation for my thesis exploration, in that the outcome of the matrix suggested that even indoor and outdoor space have an inherent connection that cannot be separated without a detriment to the occupant's full and enhanced experience of space. I term the matrix (Figure 31), Experience Generated Design Principles.

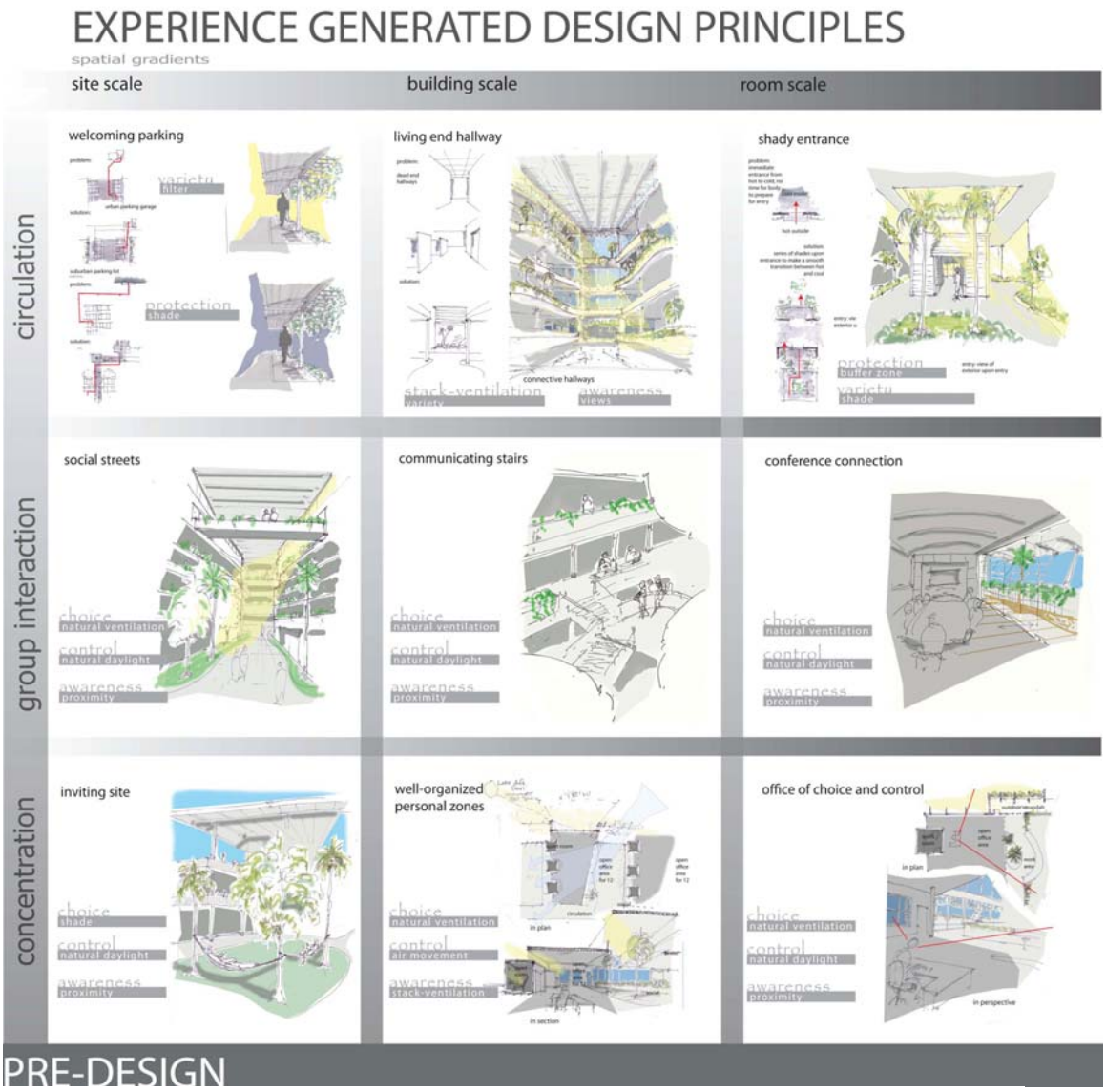


Figure 31. **Experience Generated Design Principles Matrix, to see each category in more detail, see previous pages**

4 TESTING THE NEW DESIGN APPROACH

Using the experience generated design principles developed in the above framework as the basis for a new design approach, this section describes the design project that was used to test the approach. I chose a specific site in Fort Myers, Florida and developed a client program for an international marketing firm for green initiatives called The Jeffers Group, Inc. The design principles come into effect during the pre-design phase and be a driving force throughout the development of the design. The thesis design test is based on the assumption that the designer and client will agree to consider the option of a hybrid/mixed-mode building to enhance the occupant's experience of space and place, while lowering impacts on the environment. This first section will discuss the site and analysis thereof.

Site Selection

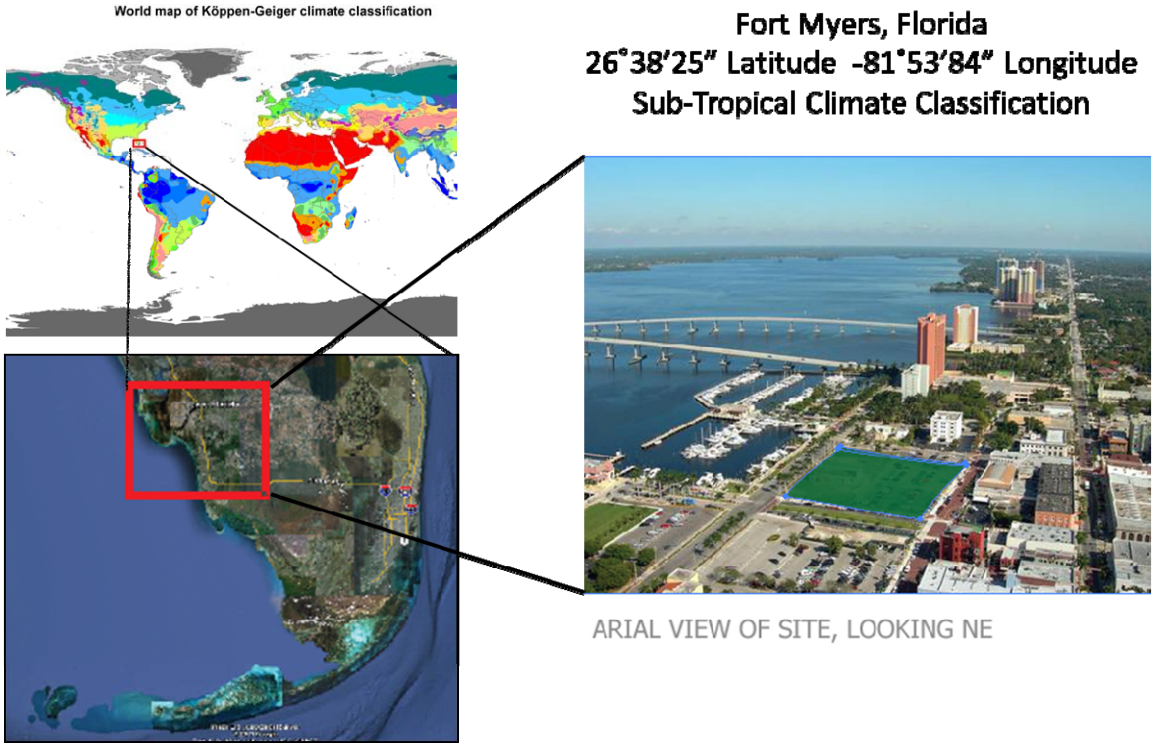


Figure 32. **Site Location: (top left) Koppen Climate Classification Map, (bottom left) Google image of South Florida, and (right) aerial view looking northeast of the site (in green)**

City Context and Character

The urban core presents many opportunities for a rich interaction between office workers and their built and natural environment. Cities themselves are full of sensorial stimuli that present a challenge for designers to control and exploit these factors with form. Currently, less developed cities, such as Fort Myers, have lost much of their residential base and are working on attracting people back to a 'liveable' city. However, the downtown core remains residentially viable for young professionals. Many condominium towers have developed along the riverfront in the last five years as well as many conversions of empty historic buildings to loft apartments. However, the overall scale of the downtown is 2 to 4 story buildings that exhibit pedestrian friendly overhangs, seating, and alleys that encourage movement and rest throughout the city.

Figure 33. **Photos taken near site of typical alleyways, textures, marina, sunset, overhangs, and vegetation**

Site History and Present Role in the City

The site itself sits directly across from the Fort Myers Public Marina and is a key feature in the 15 acre urban riverfront redevelopment plan[12]. Located directly on the river, this 3.1 acre site has been empty for decades due to various reasons involving private ownership and lack of interest. The development of Main Street in the 1990's turned its back on the riverfront. Focus was placed on the historic buildings along Main Street for downtown revitalization and historic preservation. However, the city ignored the greatest potential to draw people to live and to play in a downtown area, which was a viable riverfront.

The site for consideration, located between the downtown core and the riverfront, has great potential to expand the activities on Main Street towards the riverfront. The designer can create a pleasant path for pedestrian experience via shade, texture, access to breeze. The office occupant will also have comfortable access to the downtown core and to the riverfront, creating an environment of choice and control.

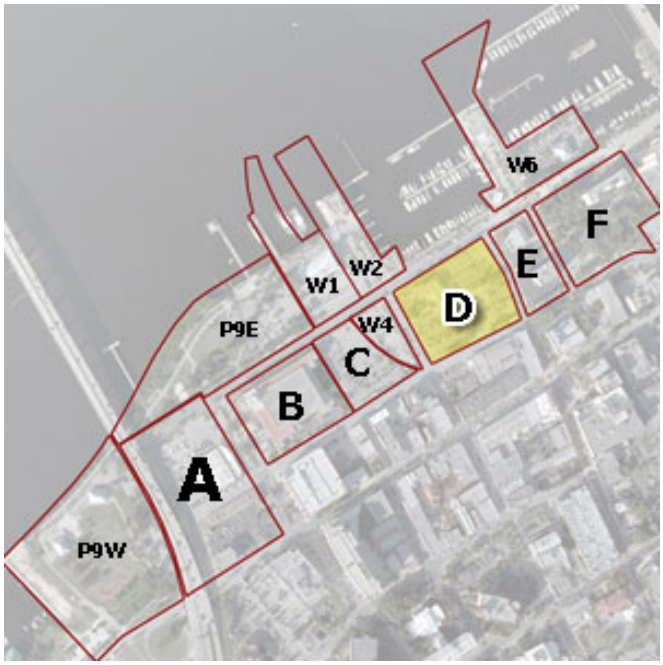


Figure 34. **Designated redevelopment properties in the Fort Myers, FL, Downtown River District redevelopment project, test site highlighted in yellow: site D. Image cited in footnote 12**

In 2002, the city began to recognize its waterfront resource and began to purchase and lease land along the riverfront. They hired Duany Plater-Zyberk & Company, Architects and Town Planners, to develop a strategy to revitalize the downtown area. Soon

[12] Duany Plater-Zyberk & Co. Prepared in April 2002. "Fort Myers River District." Amended in March 2010.

after the results from this exercise were documented in the local zoning and planning requirements, a body was designated to implement the strategies. The area of focus is called the Downtown River District and includes all the red boxes in Figure 34.

The site has been designated as Site D and is zoned for Commercial: Retail/Office use. The city's proposed purpose for this site will be to draw people from Main Street to the Riverfront with a retail component by a private developer.

The adjacent site has been designed and will be under construction in January of 2012 (as I finish this thesis). It has been designed to include an inlet of water from the river to help bring the sense of riverfront activity closer to Main Street and to entice pedestrians, workers, and tourists to move out to the riverfront amenities.

Site Analysis

Figure 35 shows a study of the urban site conditions and waterfront context with major roadways shown in brown dashed lines and pedestrian alley ways shown in red. The orange dashed lines show Main Street running parallel to the river with arrows fanning out towards the riverfront. This shows the intentions of the city for the selected site to help encourage pedestrians through and alongside the site to the waterfront amenities.

The selected site depicts an early site plan scheme that incorporates and extends the existing pedestrian alley ways (bright red) through both directions of the site.

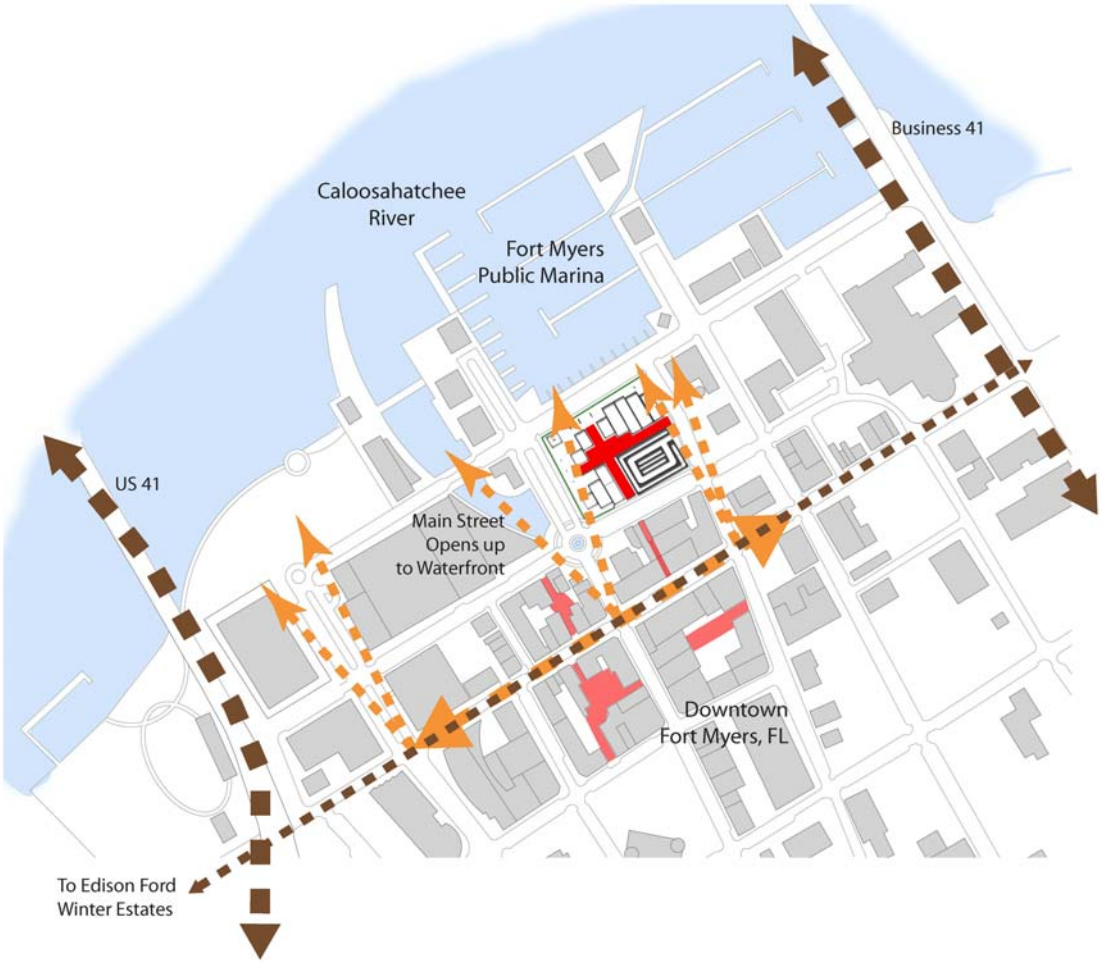


Figure 35. **Site Context study with roadways, pedestrian alleys, and City objectives**

Micro-Climate Analysis

The site is located at latitude 26˚ 38'N, which places it just above the Tropical Zone in a sub-tropical climate. This indicates that this climate does have a dry season with less humidity and lower temperatures.

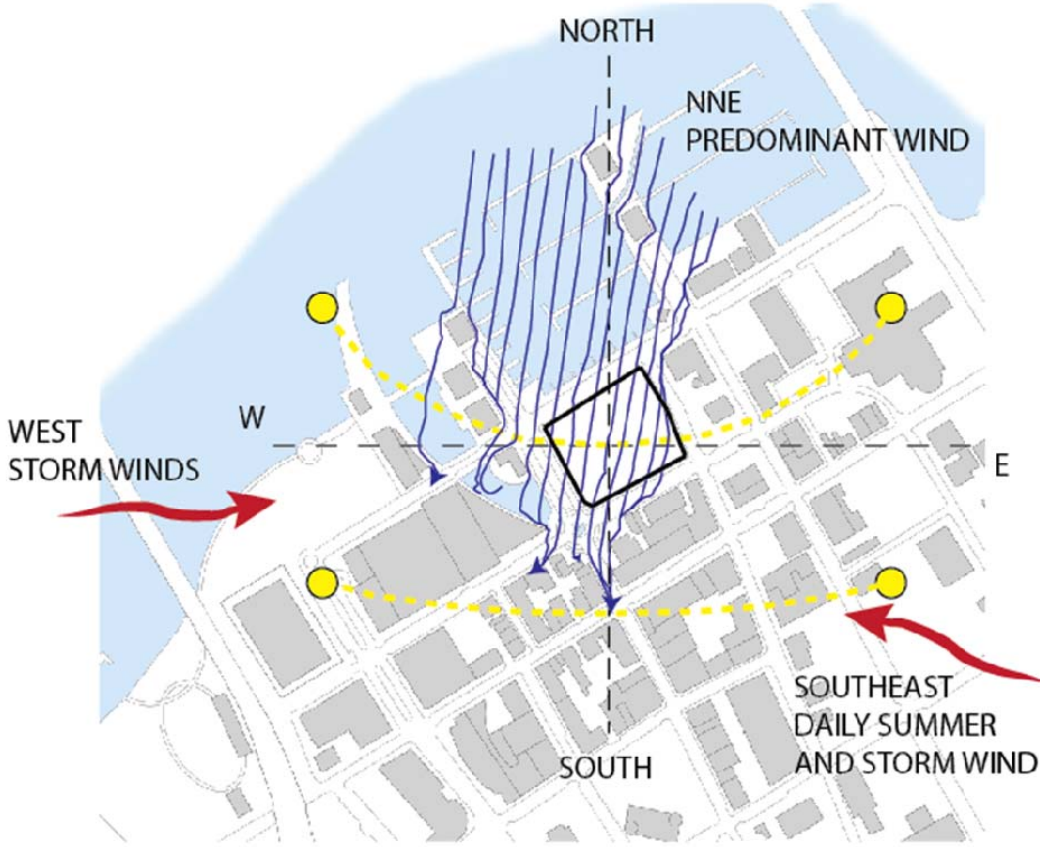


Figure 36. **Study of Micro-Climate Analysis showing sun path and wind directions**

Site Assets:
ORIENTATION: Large facade facing at 45 degrees to predominant winds during proposed season for maximum passive ventilation strategies AND northern facade faces view of river
WINDS: Predominant winds work in favor of passive ventilation strategies

Site Constraints:
ORIENTATION: West sun hits north and west facade in afternoon. Need vertical shading in this area
Winds: Summer winds are light, mechanical ventilation and/or cooling may be needed.

Program

Client

The client, The Jeffers Group, Inc., an international marketing firm, desired a headquarters located in Fort Myers due to its close proximity to the Caribbean, Latin and South America. The company represents a growing number of corporations who are taking advantage of the global environmental crisis. They specialize in marketing strategies for new “green” start-up companies and product manufacturer’s. They seek to have a building design that reflects their and their clients’ commitments to sustainability and a better future. They were not well educated regarding sustainable design, but rather wanted the designer to lead and guide them as to best practices. They understood that by doing this they were also providing for a better workplace experience for their employees.

There specific design request was to make the space much like a speculative office space such that their employees could have full freedom to design the interior office layouts at will. They do not need executive offices, but requested two prime locations for executive conference rooms and a Main Lobby that could be accessed from the Retail Plaza.

Spatial Requirements

The firm is made up of 200 employees who have a wide range of expertise such as graphic design, management, graphic production, administration, and executive officers. Approximately 50,000SF of office space would be required.

Office Space for 200 employees……30,000SF

- Open office space no larger than 12-18 employees
- Temporary private offices
- Work friendly spaces throughout the site and building

Conference Rooms at different sizes……..5,000SF
Circulation and Service Spaces……15,000SF

Speculative Office Space on 2nd through 5th floors……..150,000SF
Complete with services, circulation & restrooms

Retail Space	48,000SF
Total	248,000SF

Outdoor Plaza Area……15,000SF
Parking…….400

Design Response

Keeping the Experience Generated Design Principles matrix, and all of the site analysis and program in mind, the design response became a non-linear collection of sketching that went back and forth from program to site to individual workstations. It was immediately clear that this type of approach needed some additional organization. Referring back to the matrix for ideas about scale and activity served an important role in this new approach.

Zoning Adjustments

Due to the redevelopment nature of the site, it was allowed special provisions. If the developer would provide public parking for up to 400 cars, they would in turn be allowed to take 20% of the total base site square footage to an additional 6 stories, equaling a portion of up to 11 stories. This allowed the developer to designate five stories equaling over 150,000 SF for a mix of speculative office space and retail and to create a tower portion of the building for the main client that needed 50,000SF.

Environmental Response

Analysis of each façade and respective programmatic designation of the proposed building was made to discover potential opportunities and limitations. Façade's A & B became the primary focus for generating form in relation to program and environmental factors as discussed in the following sections.

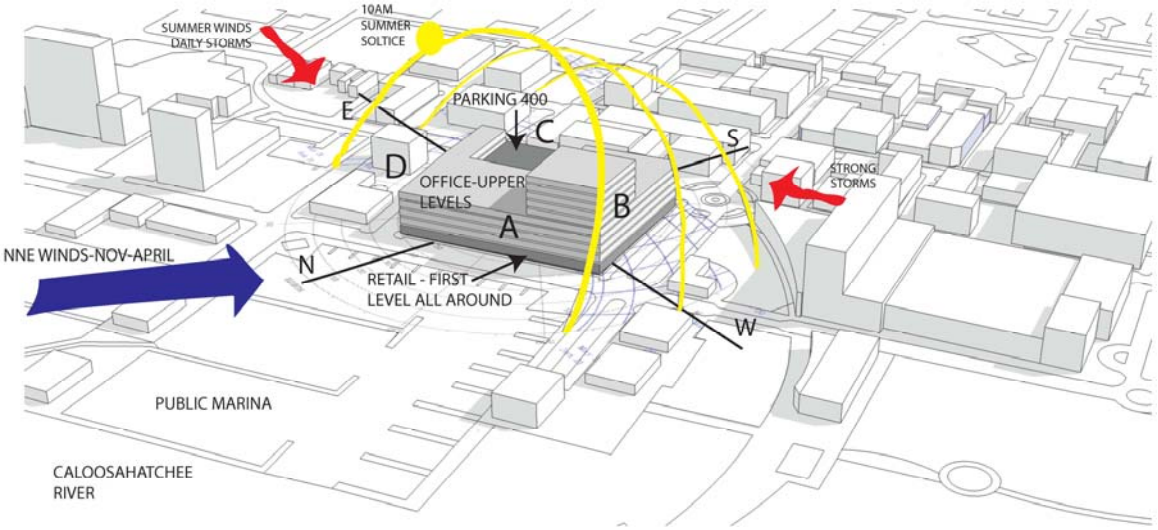


Figure 37. **Site Analysis, Sun and Wind with volume and spatial limits of building program**

Façade A: Because the predominant winds for 6 months out of the year come at the optimal angle of just less than 45 degrees to this façade and because this is the optimal time of year to use natural ventilation, this becomes the prime façade to create an envelope that admits air flow into the building and to through to the whole site. Instead of creating a menacing downwash effect at this façade (Figure 38), like many other urban office buildings, I used this as an opportunity to bring the air-flow deep into the site by creating linear offices blocks with multi-purpose spaces that I call “lanais” (Figure 39). These spaces become the lungs of the building.

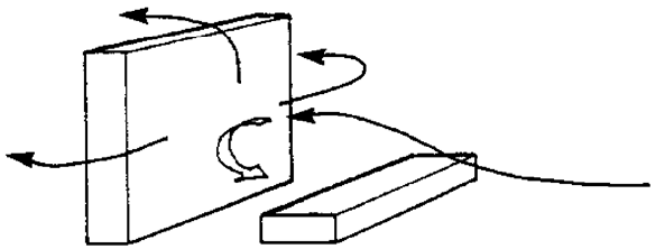


Figure 38. **Typical downwash at multi-story buildings**

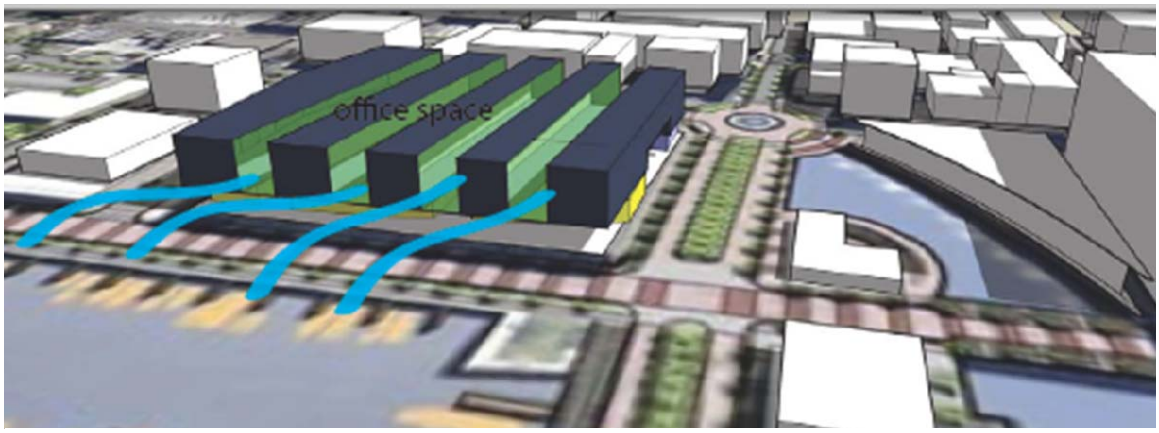


Figure 39. **Form study, avoiding downwash by allowing wind to enter site**

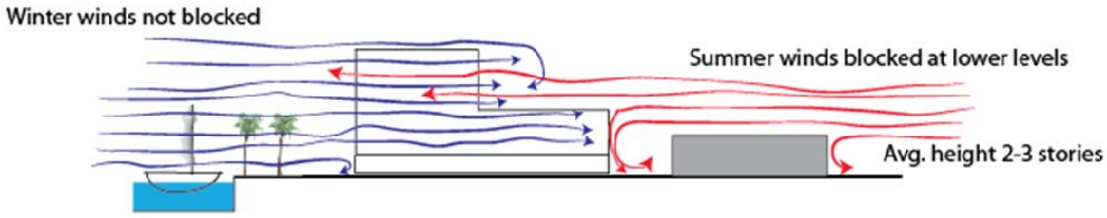


Figure 40. **Wind context diagram**

Development of the northern Façade A and western Façade B became the primary drivers for forming the overall configuration of the complex due to manipulation of natural forces and relationship to redevelopment concept.

Further development of North Façade A:

Starting Point

Program Designation, 4 floors of Office above 1 floor of retail

Raise portion of building to 11 stories total of office space, add parking garage in rear

Basic shape is modified to allow daylight and breezes deep into the site and building through “lanais”

Shade is provided over lanais and pedestrian ways

Shade plaza is developed on the West Façade B (right) to provide relief for shoppers in the River District retail complex and farmer’s market

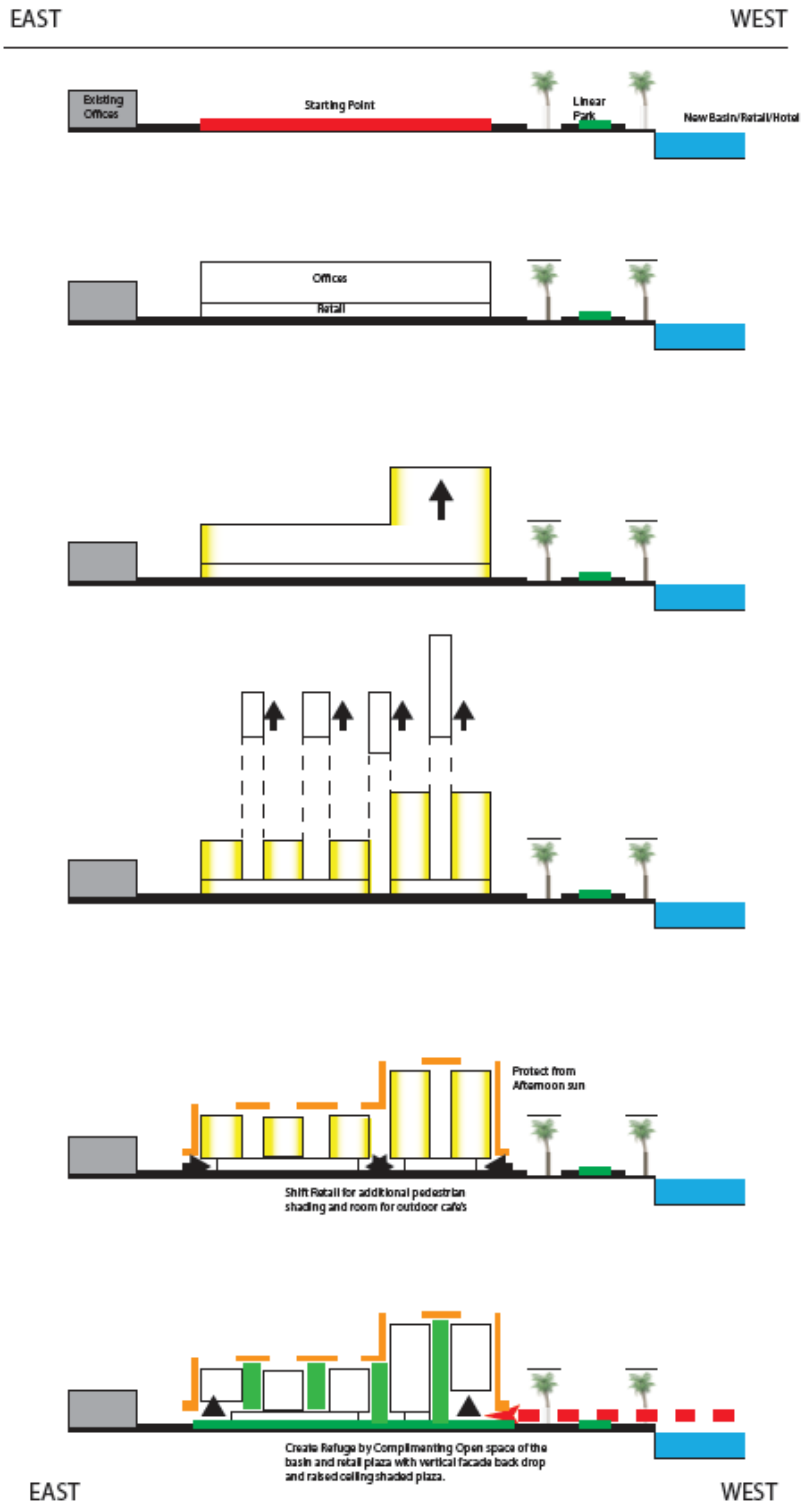


Figure 41. **Diagram development of North Facade A**

Further development of West Façade B:

Starting Point

Program Designation, 4 floors of Office above 1 floor of retail

Raise portion of building to 11 stories total of office space, add parking garage in rear

Basic shape is modified to allow for pedestrian walkways and daylight deep into the site as well as air flow

Shade is provided over lanais and pedestrian ways

Shade plaza is developed to provide relief for shoppers in the River District retail complex and farmer's market

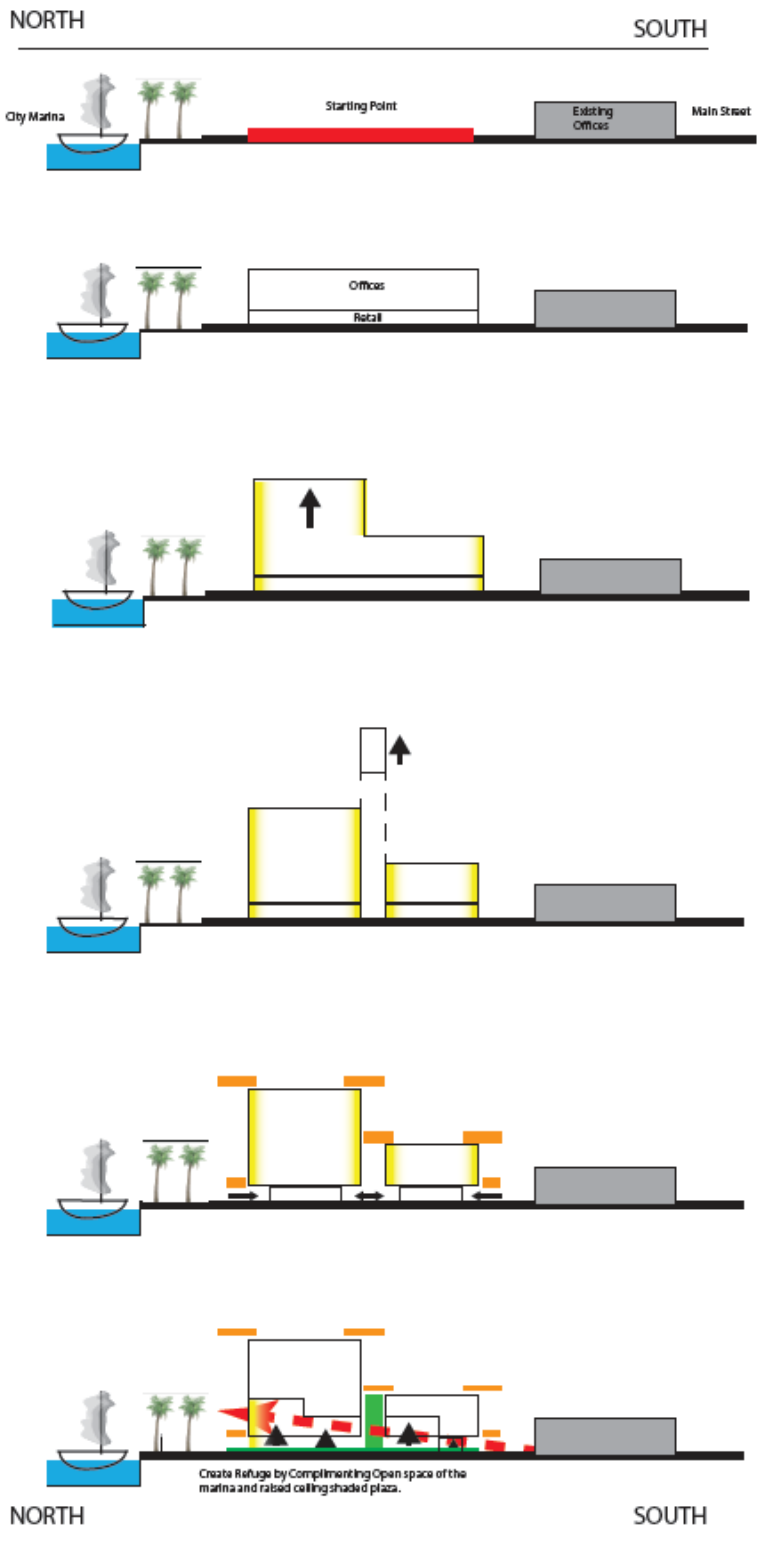


Figure 42. **Development diagrams of West Facade B**

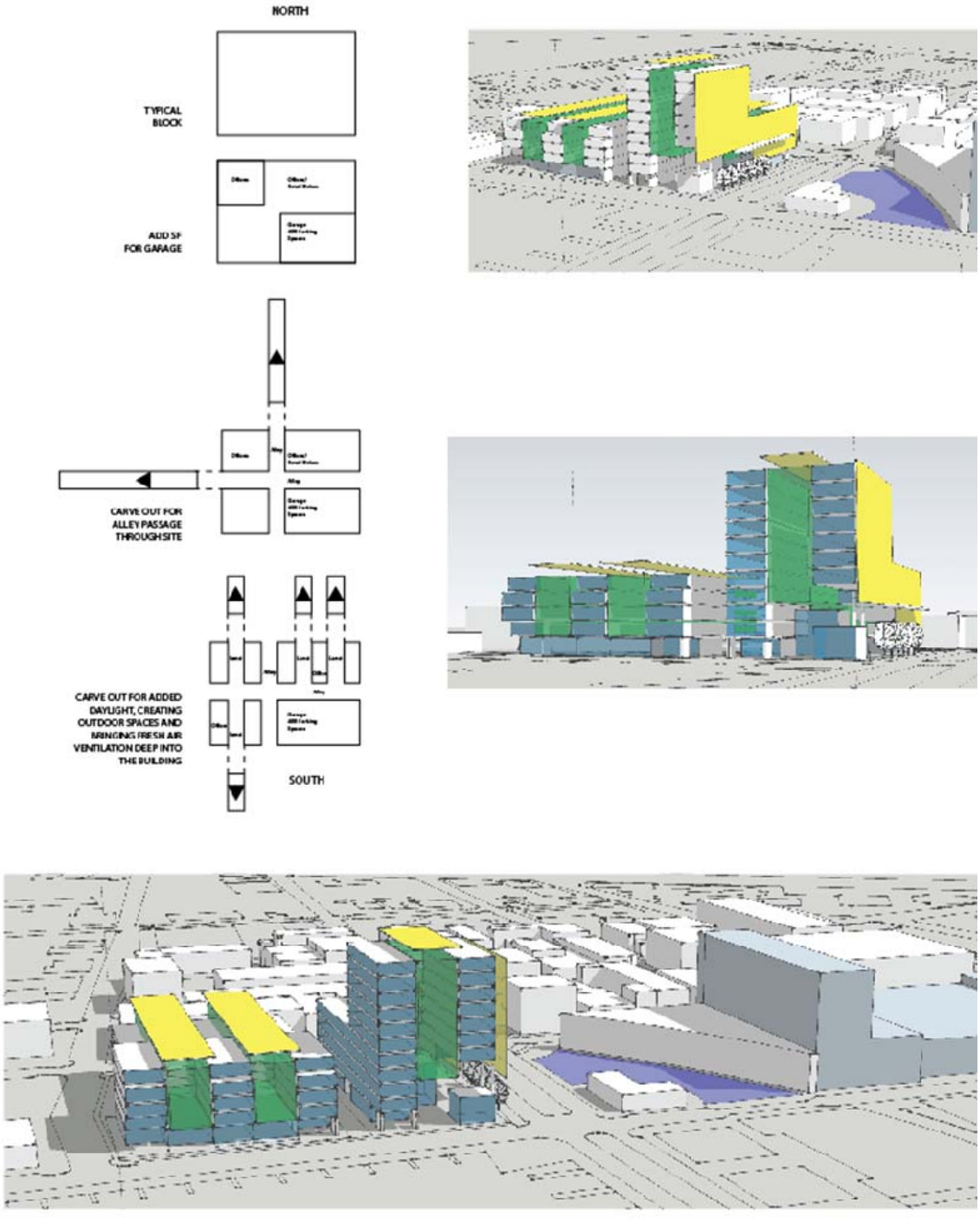


Figure 43. **Initial Form studies and diagrams**

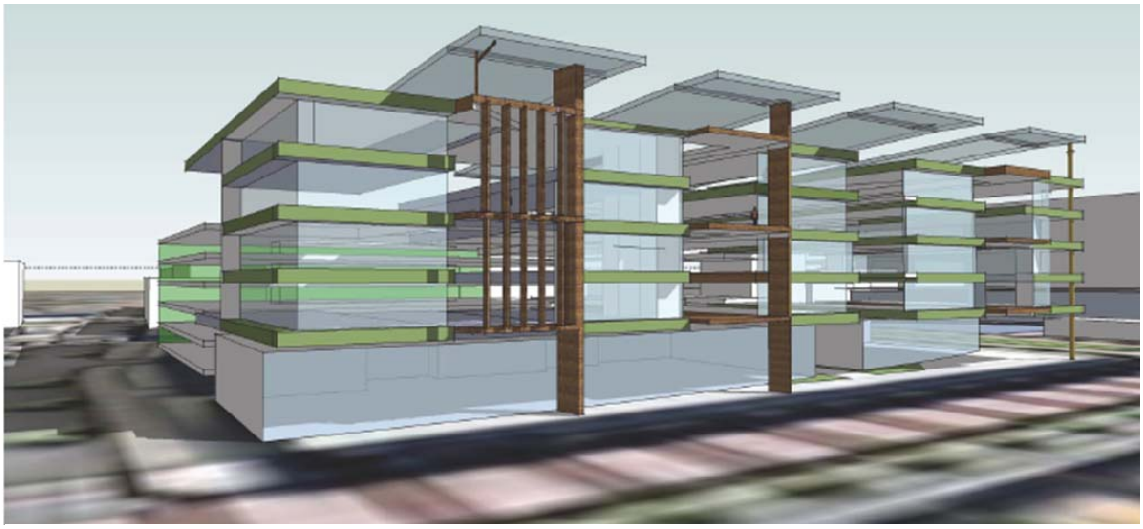


Figure 44. **Form, shade, material studies: light weight natural materials, green balconies, covered breezeways, high ceilings, lots of shade, oriented for best air flow**

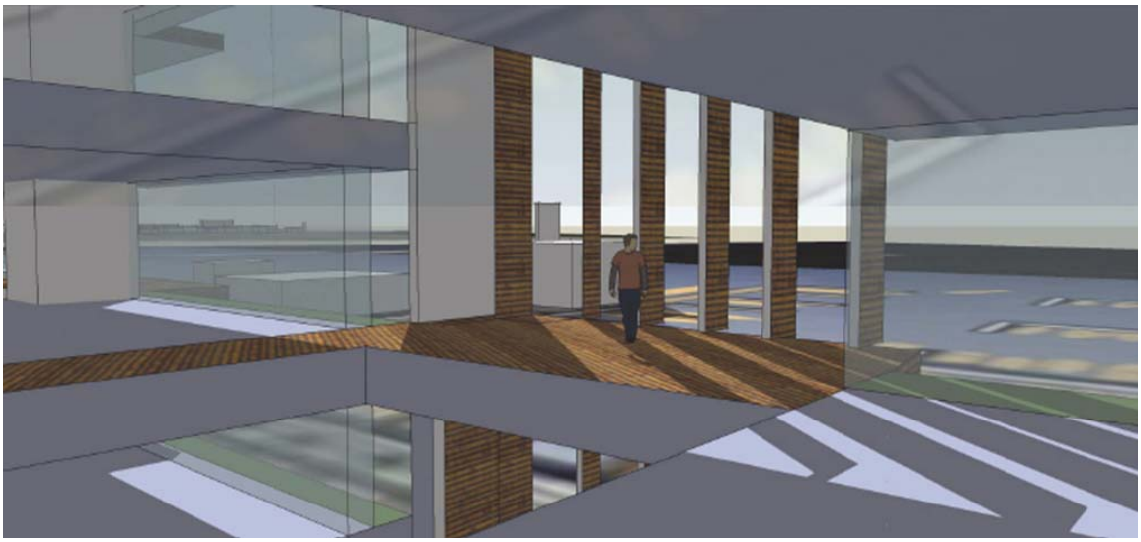


Figure 45. **Interior daylight/shade study from occupant experience as 5:00 shadows and sunlight enter work space**

Exterior form studies included sketches and studies of the relative interior perspective. This constant interior/exterior study became an important task of the new approach. This constant juxtaposition insured that the occupant interaction with the natural forces and cycles occurring outside were enhanced, filtered, controlled, and carefully designed to meet the occupant's basic needs as well as improving their overall experience. This created the inseparable connection

between the built and natural environment, evoking a sense of place and enhancing the user experience.

Designing for Air Flow

Sectional studies become very important in the design of a naturally ventilated building. In order to correctly design for proper air flow through stack and cross ventilation strategies, careful dimensions of inlets and outlets must be measured and placed.

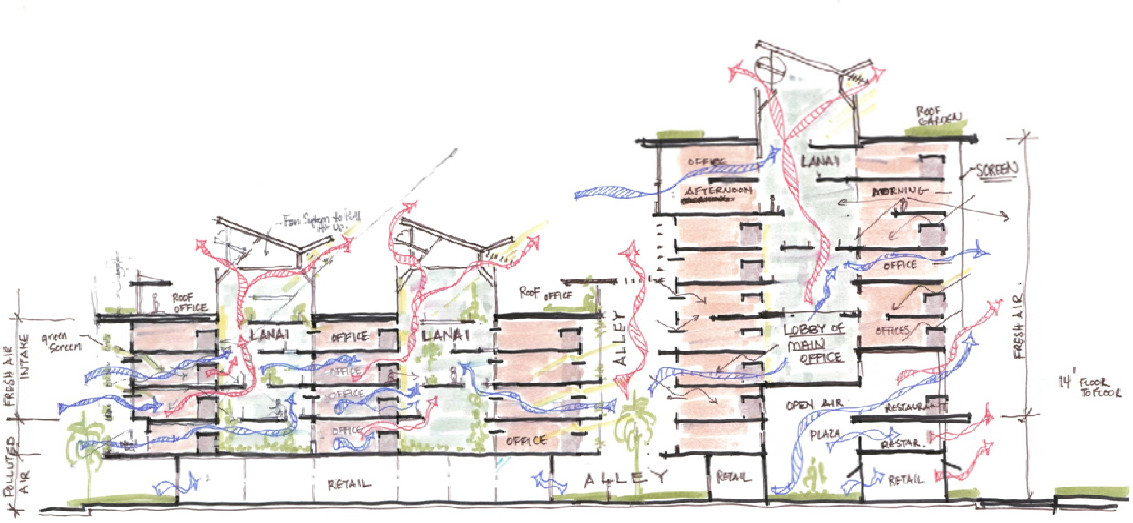


Figure 46. **Study section of overall building design for stack and cross-ventilation**

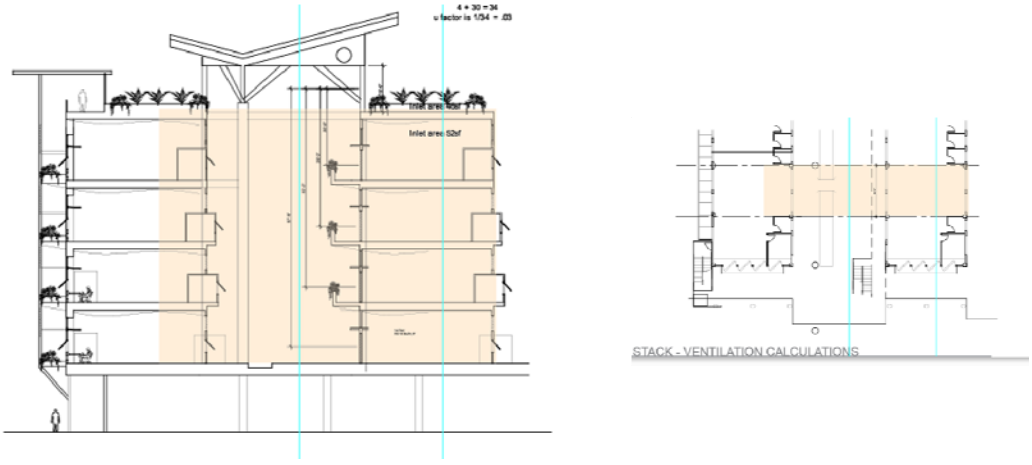


Figure 47. **Calculation diagrams for design of openings for stack-ventilation**

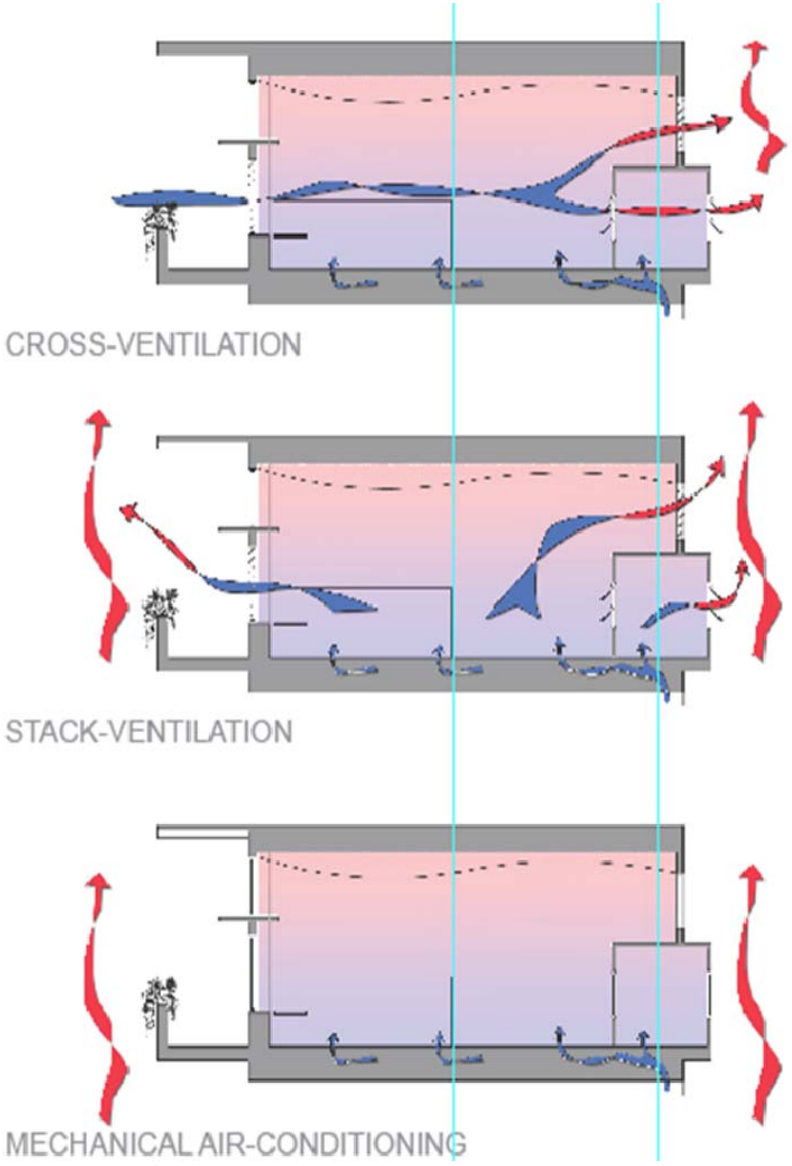


Figure 48. **Studies on air-flow in relation to openings and interior layout**

Experiential Narrative

The final design solution is made up of linear structures of four-story buildings, with courtyards, passages, landscaping, and water elements, analogous to a series of shaded gardens. The low-rise arrangement fosters communication: instead of taking elevators, people walk up stairs that encourage informal exchange; maximized visual transparency gives everybody a view and generates a sense of community and belonging; whilst the relatively small units permit employees to identify with their particular group.

Along the periphery of the complex and near circulation routes there are planting screens to filter the air and to provide visual and olfactory interest. Along the rather narrow inner gardens and streets, there are stairways and multi-use pods that offer escape from the office areas. The roof over this area is designed at angles, according to solar angle, to provide daylight, while shading and protecting from weather. They are equipped with mechanical fans to help assist air-movement throughout the year. The full height glazing allows good daylight conditions in the office spaces in order to minimize artificial lighting. The operable windows allow for control of air movement and thermal comfort.

The shaded public plaza offers an oasis and protected shopping experience. It is connected by alleyways that are pedestrian friendly and connect to existing alleyways and sidewalks to permit a natural flow through the site to the waterfront. The tower portion of the complex is where the main tenant will locate their headquarters. Together, the plaza and the tower provide orientation and add a destination/landmark to the Downtown River District.

Points of Experience

In order to fully illustrate that the new design approach was effective I used the same framework to identify and capture the points of experience in the design as I did during the development of the design principles. Each of the following pages has a matrix key in the upper right hand corner, a floor plan showing a cone of view where the point of experience takes place, and a rendering of the view. By using a simple rendering style and color palette, the renderings highlight generalized floor, ceiling, and wall planes, greenery, sky, and most importantly, people. These basic elements are paramount in developing a conceptual spatial organization that promotes certain experiences. It illustrates many systems coming together at one point in time - *an experiential detail*.

Protection

Circulation at Site Scale: Pedestrians from surrounding city blocks experience a protected walk to their destination. The weather is filtered through planting screens, overhangs and multiple ceiling heights. Landscape and vegetation give clues to air movement.

Figure 49. **Protection: Circulation at Site Scale**

Movement

Circulation at Building Scale: Outdoor circulation to differentiate but connect different areas of program. Experience protected and filtered weather while moving from building to building. These northern breezeways never have direct heat gain and can be occupied as optional workspace or social gathering.

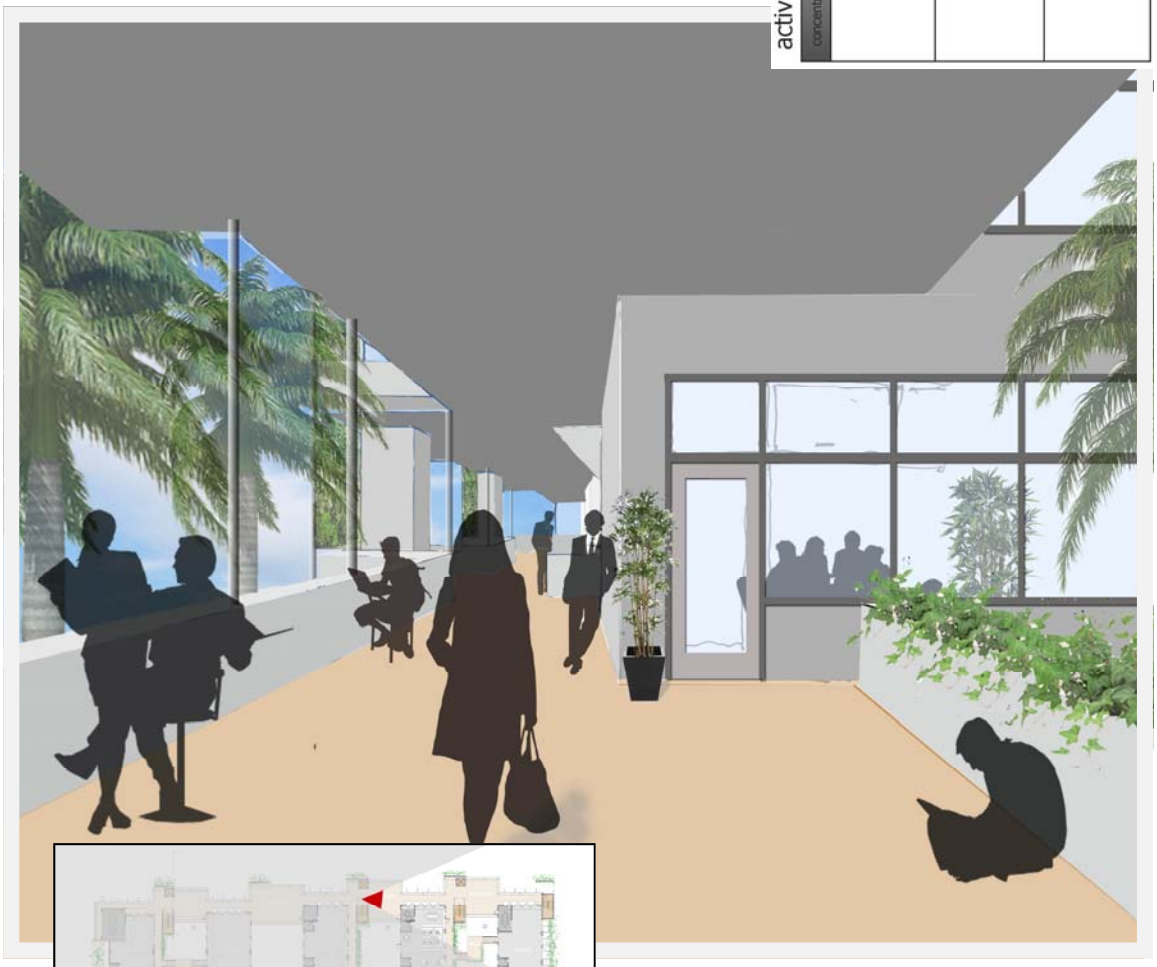
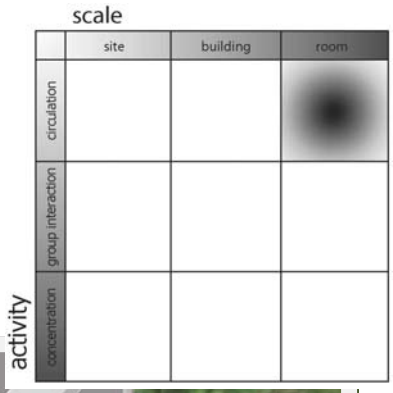


Figure 50. **Movement: Circulation at Building Scale**

Rhythm

Circulation at Room Scale: Vertical circulation nodes provide multiple ways to go through the building. Adjacent to these areas are multi-purpose areas for spontaneous gathering or places to stop and reflect on the views beyond. Movement from one space to another becomes a regular rhythm and creates a sense of life.



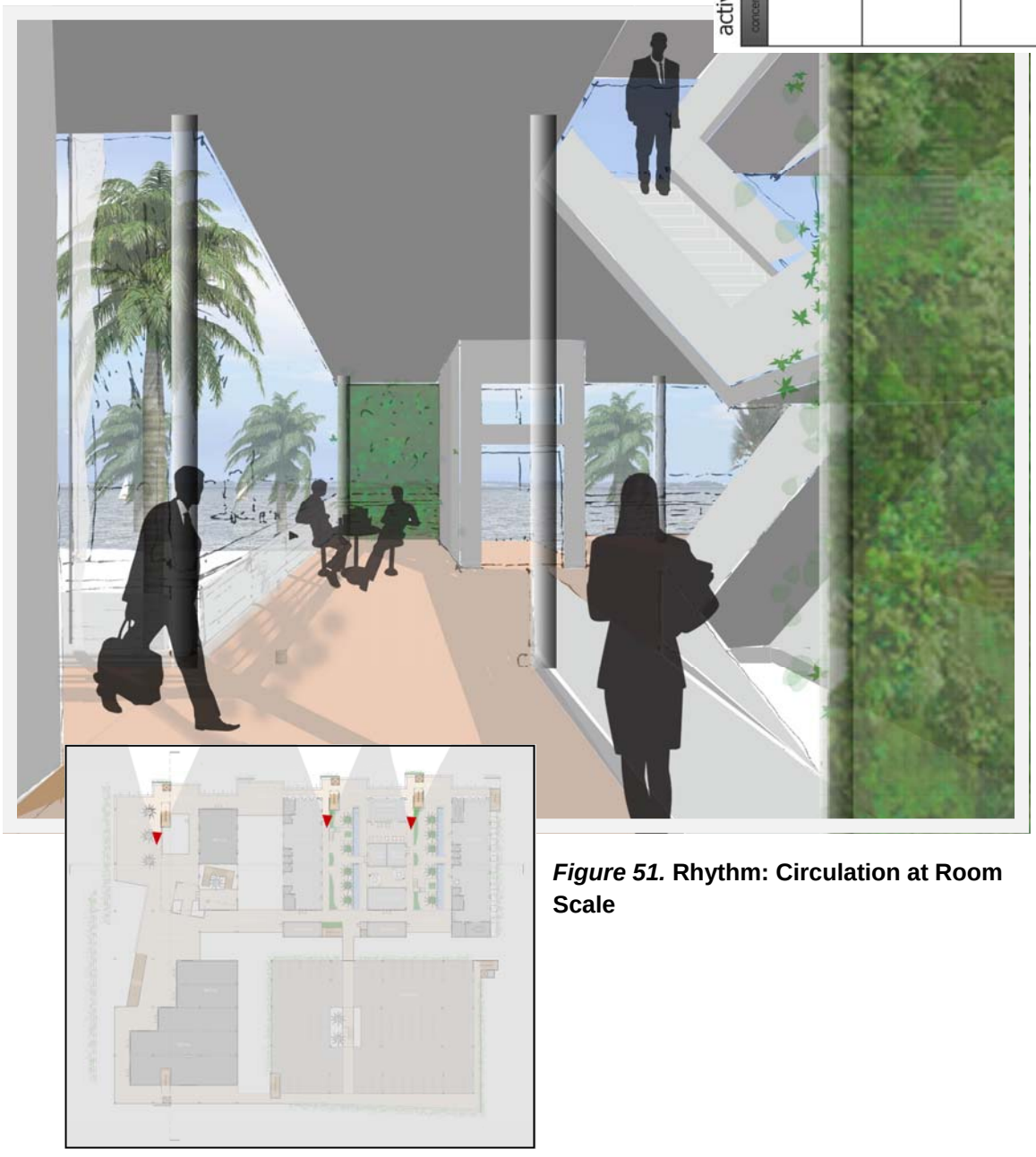


Figure 51. **Rhythm: Circulation at Room Scale**

Social

Group Interaction at Site Scale: providing interaction between public and private, inside and outside during group gatherings. Conference rooms are connected to outdoor spaces that can double as meeting areas providing buffer zones and moments of connection.

Figure 52. **Social: Group Interaction at Site Scale**

Awareness

Group Interaction at Building Scale: ability for spontaneous meetings and gatherings. These lanai spaces that were developed to allow the wind to enter deep into the site actually become the heart and lungs of the building and have multiple functions. This multi-use space provides life and a unique sense of place.

Figure 53. **Awareness: Group Interaction at Building Scale**

Connection

Group Interaction at Room Scale: conference rooms that are open to the outside and offer connection with environment and urban landscape. Ability to experience weather events and the setting sun in group settings can create memorable moments and foster connection to the environment and each other.

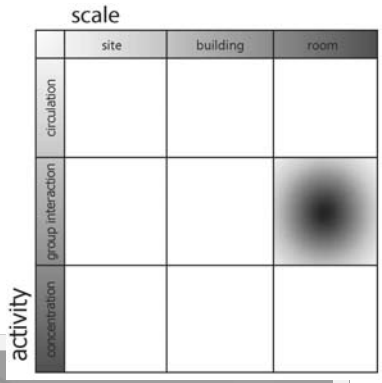


Figure 54. **Connection: Group Interaction at Room Scale**

Choice

Concentration at Site Scale: These points of experience can happen virtually everywhere in the project. All passageways, planters, roof areas and lobbies are designed to accommodate the modern office worker. With flat surfaces and built-in seating, power and wi-fi, the entire site acts as an office setting. This gives the employee choice in many different aspects: they can choose a sunny, windy, noisy, quiet, or warm place to work.

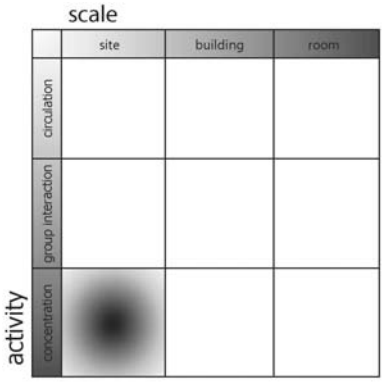
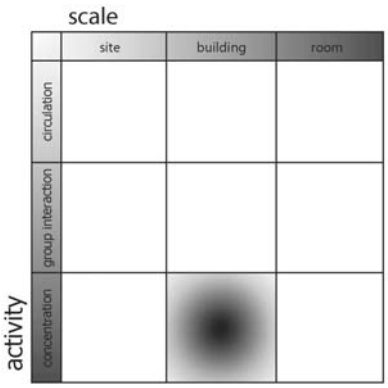


Figure 55. **Choice: Concentration at Site Scale**

Focus

Concentration at Building Scale: Open office environment that is suitable for about twelve to eighteen allows for a quiet and focused atmosphere. The open office space is equipped with a bank of temporary quiet offices where employees can get blocks of time without interruption. Work stations have adequate daylight throughout the day. Operable windows and moveable shades and screens allow occupants to make their space comfortable thermally and visually.



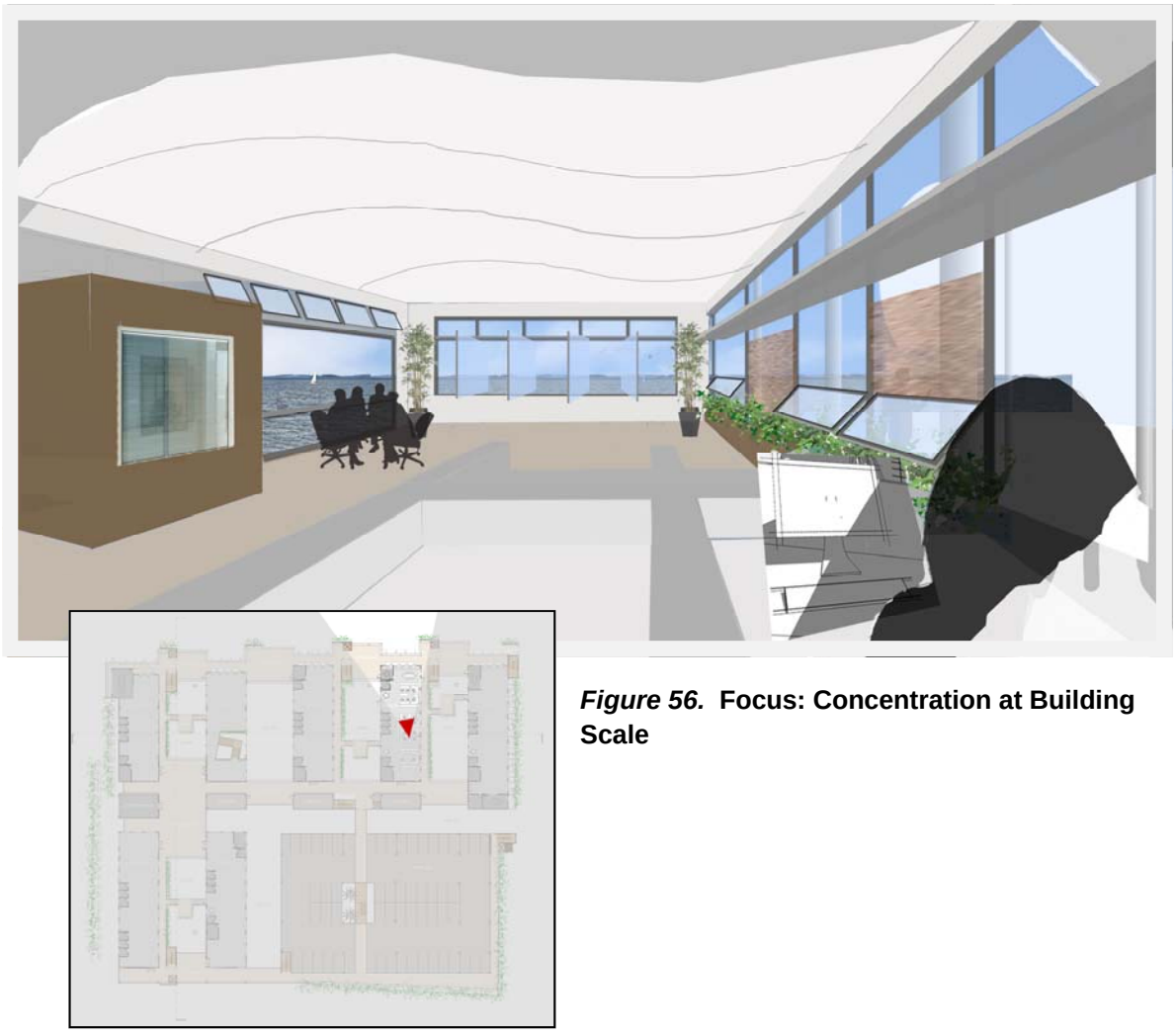


Figure 56. **Focus: Concentration at Building Scale**

Inspiration

Concentration at Room Scale: This view shows how the roof can be multi-use as well. A setting like this can offer a multitude of sensory stimuli and can be surprisingly quiet and pleasant. This offers a place where the breeze is always present, yet shade is available from the direct sunlight. Plants are growing, birds are flying, and boats are sailing by. For some, this is a choice atmosphere in which to concentrate.

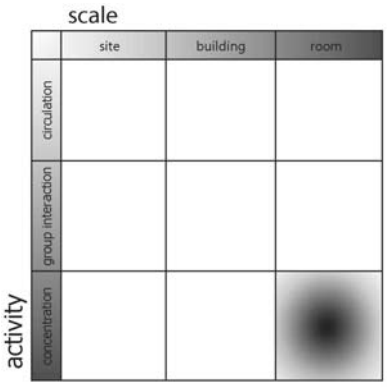


Figure 57. **Inspiration: Concentration at Room Scale**

Summary: Points of Experience

The new approach provided a framework to look at the experiential points of the occupant's daily activities. By looking at each activity at different scales throughout the building it was evident as a designer that this requires much more attention to what spatial organizations work best for the occupant and to provide for passive systems such as daylighting and natural ventilation. By looking at these points and the potential to enhance their experiential quality, I believe that this building will have less of a need for energy, will have cleaner air-quality, more of a sense of and connection to place than the average office building in South Florida.

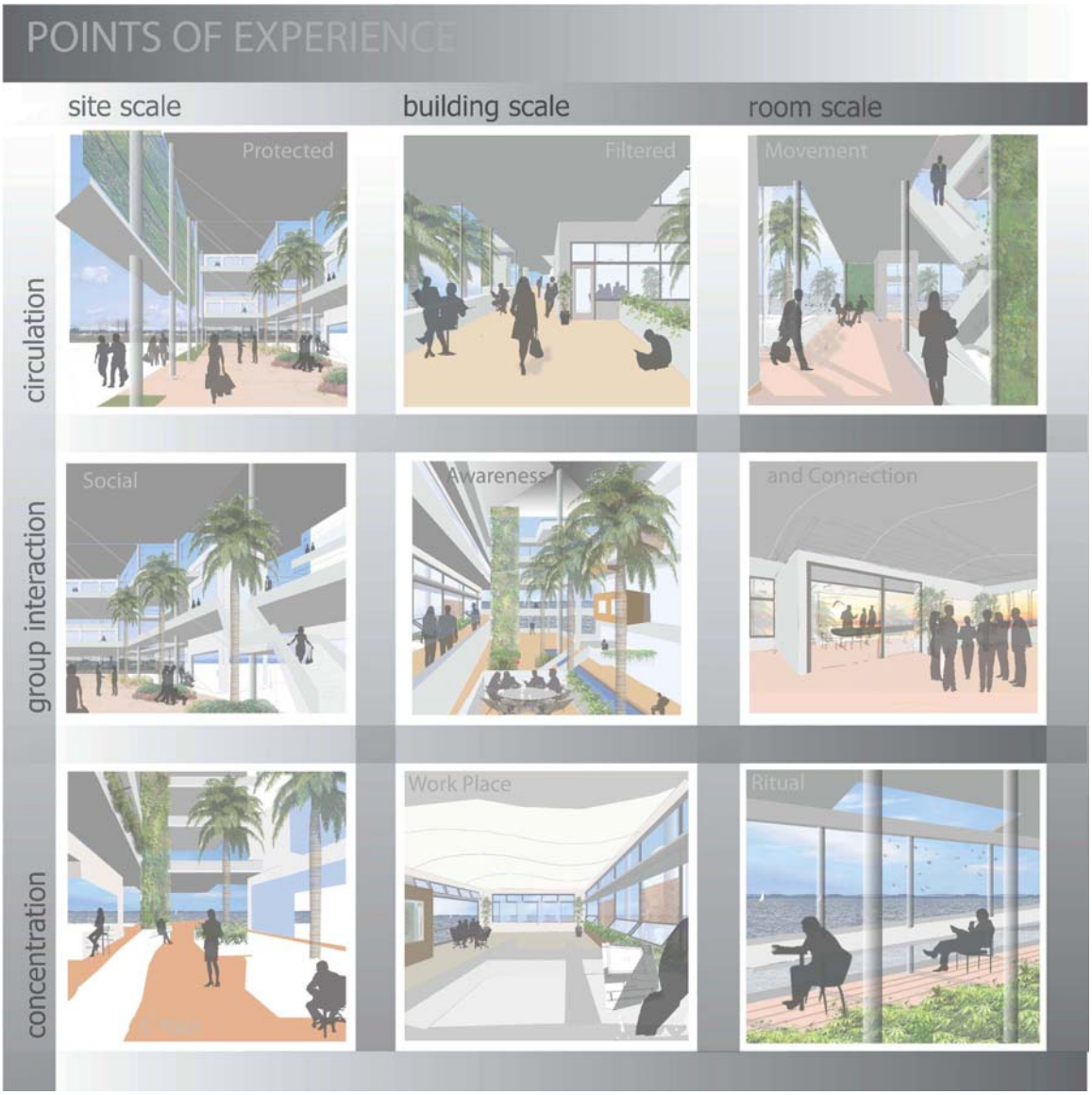


Figure 58. **Summary of Points of Experience captured in test design**

Summary: Final Design Drawings

Site Plan

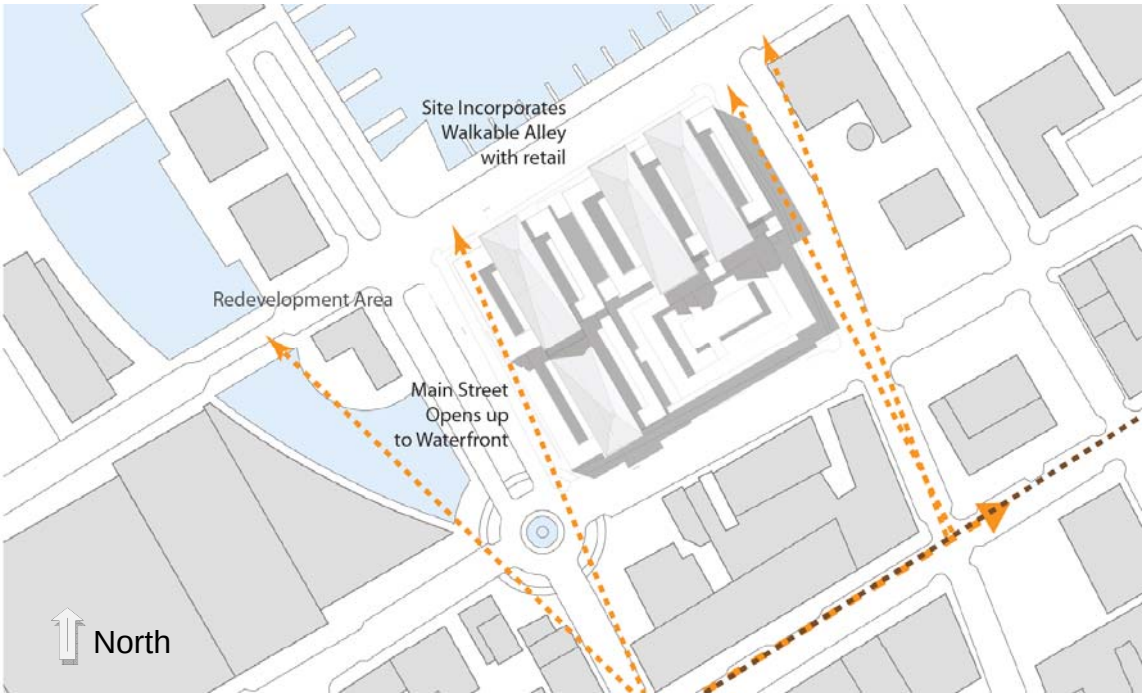


Figure 59. **Site/Roof Plan, not to scale**

Ground Level Floor Plan

1 Shaded Retail Plaza
2 Retail Space
3 Main Office Tenant Lobby
4 Pedestrian Alleys
5 Parking Garage

Figure 60. **Ground Level Floor Plan**

Second Level Floor Plan

1 Second Level Shaded Retail Plaza
2 Retail Space
3
4 Office Space
5 Lanai Plaza
6 Conference Rooms and Café
7 Parking Garage

Figure 61. **Second Level Floor Plan**

Second Level Floor Plan

1 Covered Circulation Routes that also act as work and gathering spaces
2 Office Space
3 Service Spaces/Bathrooms
4
5 Parking Garage

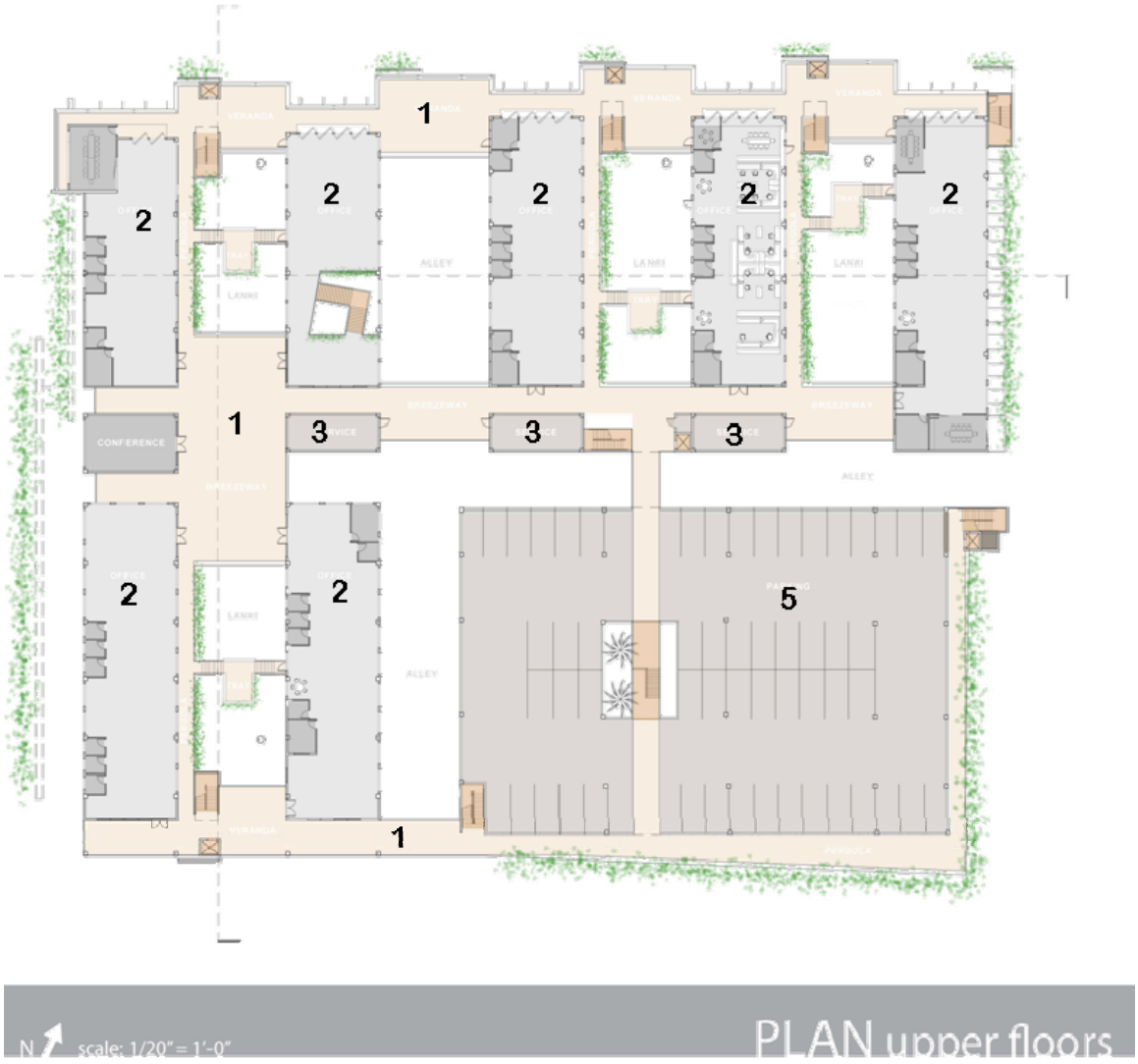


Figure 62. **Upper Floor Plans, Typical**

Building Sections

Figure 63. **Cross section from east to west**

Figure 64. **Cross section from north to south**

Main Elevations

***Figure 65*. North (Riverfront) Elevation**

***Figure 66.* West Elevation**

5 CONCLUSION

This thesis has largely been an exploration of finding out what factors constitute an enriched experience through the relationship between people and places. Architects can never predict exactly how someone will feel, respond to, or experience a particular space, no matter how carefully designed. That is why is imperative for designers to use an approach that uses multiple factors to contribute to the development of spatial organization. By understanding our occupants as more than x's and y's in a set of calculations, we can become better designers. During these extraordinary times, we will need this approach to prove our ability to adapt and create, and we can't leave it solely to technology to solve our problems this time.

Results

The experience generated design principles that were developed as a pre-design approach throughout this thesis were successful in that they helped to generate a design that allowed occupants to interact with the natural forces at their own will, thus creating multi-sensory and enhanced experience of place. The occupants in this design have control and choice in the context of their interaction with the exterior spaces. They also have the ability to make themselves comfortable by migrating throughout the building or simply having the ability to open a window or move into a temporary quiet office. The building's circulation routes and lanais are designed to stimulate the senses and create a sense of life, rhythm, depth, and connections, much like the porches, pergolas, and breezeways that were built by our biological ancestors.

Implications

The results of this study implies that the design approach for office buildings should include more awareness of how humans perform modern office work activities and how their connection to the natural environment helps to fulfill and meet the basic human needs that improve performance and well-being.

The design approach results suggest that it is possible to create zones throughout the building that can help offer choices and control to occupants to the desired amount of heat, sunlight, breeze, noise level, and view.

The design approach also illustrates an important implication to the future of the design profession. Designers should think in a more integrated way towards buildings, people and environment. Architecture is a field where

designers should take initiative in finding ways that man and nature can work together by way of the built environment.

Limitations

Perceived Cost

While the prevailing perception that designing for passive systems is more expensive than conventional systems, the designer can educate clients very quickly that while this may be true for upfront costs, the lifecycle cost for energy and production expenditures pay back in multitudes. In Figure 67, the pie chart shows that salaries make up for 84% of business costs. If the design of a building can increase productivity by even 1% point, the savings can nearly offset a company's entire annual energy cost.

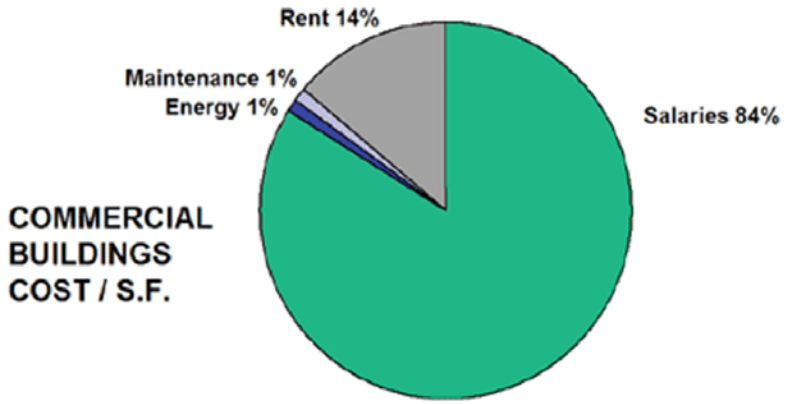


Figure 67. **Commercial Building's Bottom Line, H.M.G., 1999**

If the HVAC systems can be drastically reduced through this new design approach that adheres to microclimate conditions and reduces load requirements, the cost savings will also be considerable.

Fire Codes

The design of hvac systems in buildings has become so standardized that most of the fire-codes are based on these design parameters. In some cases, designs with passive systems might be more likely to assist the spread of a fire. Currently there are ways to mitigate such instances through designing sprinkler systems and smoke evacuation routes. Architects understand the importance of keeping buildings safe, but isn't there also merit to providing a sense of place and a positive experience in buildings on a daily basis? The fire codes need to be challenged and presented with more creative and new ideas to allow for open air designs, while also keeping buildings safe.

Future Research

The need for further research into the perceptions and experiences of humans is needed to inform better practices of design. An integrative approach taking more than one factor into consideration will give more well-rounded research in which to base our design decisions. As society is coming out of a very empirical, scientific age, I believe that a more holistic way of thinking will become the norm in that people will begin to understand that phenomena are not isolated events, but rather a part of a larger set of systems and events that may not operate the same as our idealized scientific formulas have led us to believe. I have hope that this “enlightenment” will reveal the resilience of mankind and its ability to work together to solve problems.

LIST OF REFERENCES

Books

Ackerman, Marsha. *Cool Comfort: America's Romance with Air Conditioning*. Smithsonian Institute. (2002)

Alexander, Christopher. *A Pattern Language*. Berkeley, California. (1977)

Augustin, Sally. *Place Advantage: Applied Psychology for Interior Architecture*. John Wiley & Sons, Inc.: Hoboken, NJ. (2009), page 181

Banham, Reyner. *The Architecture of the Well-tempered Environment*. The University of Chicago Press: Chicago, IL. (1984)

Brown, G.Z., DeKay, Mark. *Sun, Wind & Light: Architectural Design Strategies, 2nd edition*. John Wiley & Sons, Inc: New York, (2001)

Cassidy, Tony. *Environmental Psychology: Behaviour and Experience in Context*. Psychology Press, Publishers: East Sussex, UK. (1997)

Cox, Stan. *Losing Our Cool: Uncomfortable Truths about our Air-Conditioned World*. The New Press: New York, NY. (2010)

Edwards, Brian. *Green Buildings Pay*. Spon Press, New York, NY. (2003)

Kahn, Peter. *The Human Relationship with Nature*. MIT. (1999)

Kellert, Stephen R. & Heerwagen, Judith. *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life*. John Wiley & Sons, Inc.: Hoboken, NJ. (2008)

Knowles, Ralph. *Ritual House*. Island Press: Washington D.C. (2006)

Malnar, Joy & Vodvarka, Frank. *Sensory Design*. University of Minnesota Press: Minneapolis, MN. (2004)

Pallasmaa, Juhani. *The Eyes of the Skin: Architecture and the Senses*. John Wiley & Sons, Inc.: England. (2005)

Rasmussen, Steen Eiler. *Experiencing Architecture*. MIT Press. (1959)

Susanka, Sarah. *Home by Design*. The Taunton Press, Inc., CT. (2004)

Tuan, Yi-Fu. *Space and Place*: The Perspective of Experience. The University of Minnesota Press: Minneapolis, MN. (1977)

Websites

Archinology. www.archinology.com. last visited May 10, 2011

The Whole Building Design Guide. www.wbdg.org. last visited May 10, 2011

Articles

Fisk, William J. “How IEQ Affects Health, Productivity.” Ashrae Journal, May 2002.

Heerwagen, Judith. “Psychosocial Value of Space.” Whole Building Design Guide. http://www.wbdg.org/resources/psychspace_value.php (2008)

Heerwagen, Judith, K. Kampschroer, K. Powell, and V. Loftness. “Workplace Research: Collaborative Knowledge Work Environments.” Building Research & Information, 2004, 32(6): 510-528

Parker, Danny S. “Energy-Efficient Office Building Design for Florida’s Hot and Humid Climate.” Ashrae Journal, April 1997

Thayer, Burke Miller. “Daylight & Productivity at Lockheed.” Ashrae Journal, May/June 1995.

VITA

Joleen Darragh graduated from Drury University in Springfield, Missouri with a Bachelor's of Architecture and a Bachelor's of Art in Spanish in 2000. After four years of working in the architectural field she obtained her architect's license in the state of Florida in 2004. She has had her own practice since that date. She subsequently obtained her license in the state of Tennessee in 2008 and in the state of Georgia in 2011. In 2010 she began to pursue a Masters of Architecture with an emphasis on Sustainability, which she will be awarded in May 2012. She plans to bring the new knowledge obtained from conducting the research for this thesis into her practice of commercial architecture.

She will continue research on an experience generated design approach, as well as, exploring its applicability as a design tool for the profession at large. She is also interested in becoming active in the classroom with the cause of helping students be better prepared for the realities of the practice of architecture.

She currently resides in Sweetwater, Tennessee with husband, Jeff, and four children, Chloe, Caleigh, Caroline, and Corban.